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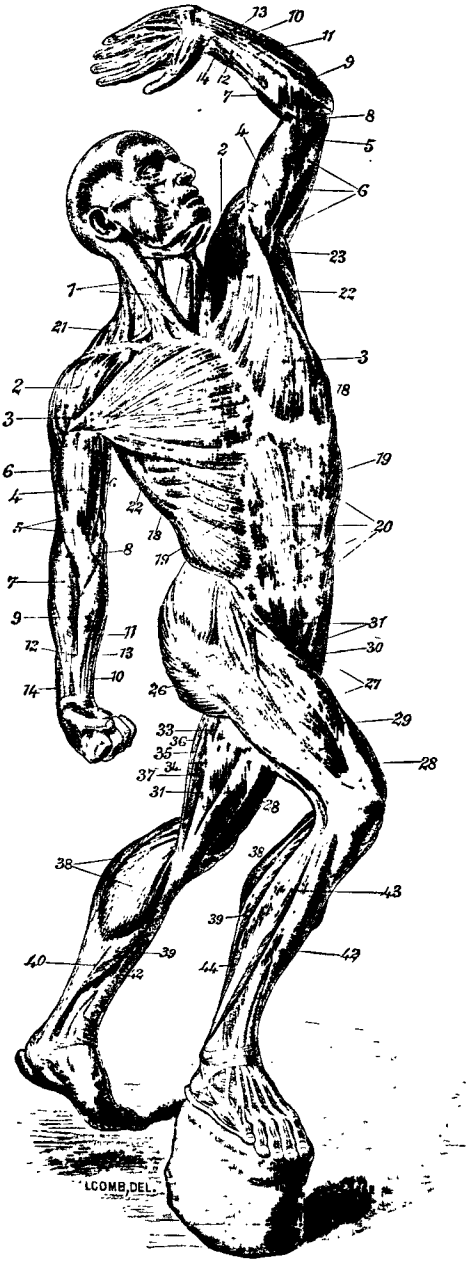

THE MUSCULAR SYSTEM.—PLATE I.

For the explanation of this Plate, *see* Chapter V. (pp. 40 *et seq.*), THE MUSCLES OF THE BODY.

HOME GYMNASTICS

FOR YOUNG AND OLD

BY

PROFESSOR HOFFMANN

AUTHOR OF "MODERN MAGIC," "MORE MAGIC," ETC., ETC.

WITH 59 ILLUSTRATIONS

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"The wise for Health on *Exercise* depend."

—DRYDEN

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PREFACE.

THIS little book is the outcome of a personal experience. The writer has on several occasions found himself in the condition popularly known as "below par," neither mental nor physical powers reaching their proper level. Medical advisers were agreed as to the cause—the too sedentary conditions of a literary life—but none of the remedies suggested gave more than temporary relief. Finally, however, a medical friend, who had made a study of such cases, indicated a course of treatment, the chief element of which was a daily half-hour employed in certain special dumb-bell exercises. The prescription proved so marvellously effective as to suggest, in the interest of others, the desirability of acquiring a closer acquaintance, theoretical and practical, with the subject of HOME GYMNASTICS, and this little volume is the result.

Of works on Gymnastics there is no lack, but their authors, as a rule, devote their space to the

more showy feats performed with the aid of fixed apparatus, and either ignore or dismiss with a few curt pages the homelier exercises with dumb-bells, pulley-weights, &c. The latter, however, have in truth a far wider application, and consequently higher value. The feats of the gymnasium can only be practised in the gymnasium; a most serious limitation of their usefulness. They are only suitable for young and vigorous persons, and demand for the most part an amount of skill as well as strength, only to be acquired by an arduous course of training. The exercises described in this book may be practised in any home. They may be used, with slight and obvious modifications, by any one; man, woman, or child. The weak will become strong, and the strong stronger by their use; but developed muscle is the smallest of their gifts. Healthier appetite for food, sweeter sleep and brighter waking hours, greater vigour for work or play, in a word, keener all-round enjoyment of life, will be the sure reward of anyone who will fairly test and persevere in the exercises here recommended.

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HOME GYMNASTICS.

CHAPTER I.

INTRODUCTION.

"THE first Wealth," says Emerson, is "Health." Certain is it that, lacking health, all other wealth is but of little value. Unfortunately, the two kinds of wealth by no means always go together; indeed, it is a constant experience to find the man best furnished with worldly comforts, least able, for lack of health, to enjoy them. The daintiest dishes have no relish for his feeble appetite, and even the plainest food renders him a victim to dyspeptic tortures. He is flabby, puffy, scant of breath; the smallest exertion is a toil to him; he travels through life in a condition of chronic weariness, and is fortunate if he escape the added pains of gout.

Nor is the millionaire the only sufferer: the same ailments, varying in degree, are the curse of thousands of middle-class men in every great city. The lawyer in his chambers, the merchant in his

office, the literary man at his desk, are all more or less victims of the same tormenting demon, a demon of many aliases, but whose most approved name is Nervous Exhaustion. Some fly to delusive "tonics," others to still more delusive "nips," which only aggravate the evil they are designed to cure. "When the overworked man of business, having been on his legs all day, and feeling fit to drop, with a sensation of 'all-goneness' about the region of the stomach, *rouses* himself with whatever he may be in the habit of taking, be it whisky, champagne, or even tea or coffee, he does not add one atom of force to his stock of energy, but having put to sleep his sense of weariness, simply appropriates some of his reserve for the present necessity. He has accepted a bill at short date to which a ruinous rate of interest is attached, and his resources will not allow him to make many repetitions of the experiment. His account at the bank of life will soon be overdrawn. Alcohol cannot add one iota to his reserve of nervous energy, though it may delude him into exhausting it."* Medicinal "pick-me-ups" are only less injurious as being less seductive to the palate, and less constantly available. Even where taken under the advice of a medical man,

* *Health Troubles of City Life*, by George Herschell, M.D. (Swan, Sonnenschein & Co.) An admirable little work, well worthy the attentive perusal of all brain-workers.

they give but passing relief, and the often prescribed fortnight's rest, or trip to the seaside, is in like manner only temporarily effective, the return to the "mill" being followed, sooner or later, by a recurrence of the old symptoms.

The first step towards finding a remedy for this quasi-invalidism is obviously to discover its causes. These doubtless vary more or less. Over-work, and still more, over-worry, yearly slay their thousands; but there is a wide margin of cases (indeed, the far larger number,) in which neither of these explanations is admissible. Men in the prime of life, in assured financial and social positions, and working solely at their own pleasure;—ladies of fashion, with little or nothing to do, and only self-created worries,—are still found to be victims of the nervous exhaustion plague. What is the common element in such cases? Nine times out of ten it will be found that the cause of the evil can be stated in three words,—INSUFFICIENT BODILY EXERCISE.

It is only within the last few years that even medical men have begun to realise, in a practical sense, that sufficiency of bodily exercise is a primary condition of healthy life. Theoretically the fact has long been admitted. The great Sydenham, the father of English Medicine, writing in the seventeenth century, says, "If exercise

be omitted, all the remedies which have hitherto been discovered will not at all avail." With his dying breath he enforced the same lesson. "I am content to die," he said, "since I leave behind me three great physicians, Air, Water, and Exercise." Abernethy used in like manner to say that the only remedies for nervous diseases were air and exercise. Fuller, the author of the *Medicina Gymnastica* (1705), a book which passed through nine editions, says, "Exercise is to physic, as bandage is to surgery, an assistance, or medium without which many other administrations, though never so noble, will not succeed. It is a kind of reserve, but yet of that efficacy that the thing you most depend upon, though in itself very powerful, may yet receive its *dernière puissance* from this reserve. And to this it is, that we must undoubtedly attribute the wonderful success that the ancients had in their curing with such indifferent materials as their pharmacy afforded them." Equally eminent authorities in every generation have testified to the same effect. But all medical men are not equally honest; and when they do speak the truth, the public do not always take it to heart. A recent writer, Dr. Oscar Jennings,* puts the medical man's side of the matter very fairly: "It is indisputable," he says, "that

* *Cycling and Health*, by Oscar Jennings, M.D. Iliffe & Son.

exercise and regimen are but too rarely insisted upon by physicians, which is the more surprising now that the benefits of the various forms of all athletic exercises in the education of the young are universally recognised. The explanation seems simple, however. To-day, when money is supreme, when even "time is money," and every hour is counted, people insist on being treated *tuto, cito et jucunde*, that is, with the least possible trouble to themselves. From necessity, doctors are compelled to fulfil these conditions. Invalids demand sedatives for their nerves, provocatives for their appetites, and narcotics to secure sleep, and they are practically compelled to order the fashionable remedies of the day. . . . In a vague kind of a way every one knows that exercise is necessary for the maintenance of health—that exercise and diet may be employed as a means of treatment; and they are often prescribed in an indifferent kind of a way, by medical men. But notwithstanding the fact that half the chronic diseases from which we suffer are absolutely and wholly curable by exercise and diet, there is not one physician in a hundred who preaches this truth to his patients. I say '*preach*,' because in this matter an off-hand counsel is generally useless. Patients are so accustomed to expect health from physic, that it is necessary to preach and persuade them to the contrary.

I have then no hesitation in preaching, that the great majority of those who lead miserable lives in consequence of nervous prostration, insomnia, neuralgia, gout in its innumerable manifestations, rheumatism, liver diseases, diabetes, and a host of other troubles, and who pass most of their time in consulting and doctoring, might by the proper use of diet and exercise, be restored to perfect health.

"The chief reason why medical men do not insist on this point sufficiently is that the honest enthusiasm for the ideal in medicine is soon blunted by the immeasurable stupidity and injustice of the public in matters of this kind. The man who has fifty times told an anxious mother that no medicine whatever is required, say, for chicken-pox, and who has seen his patients snapped up regularly by a smarter practitioner who shrugged his shoulders indulgently, and prescribed some pink water, finally realises that pink water is the best policy; and although a young practitioner with a head full of science may begin life by recommending temperance and sobriety to the over-fed dyspeptic, he soon learns that if he is to live by his practice he had much better lose no time and order blue pill. *Populus vult decipi.*"

So outspoken a statement by a member of the medical profession should be taken to heart by every thoughtful reader. It is at once a forcible

testimony to the value of nature's remedies, and a scathing rebuke to those who reject them. The public, unfortunately, do not always hear such plain speaking, though any one even slightly acquainted with the books written by medical men for medical men could quote scores of similar passages.

On the broad question, however, of the value of exercise as a remedial agent, the case does not rest upon mere professional opinion, however eminent, but is demonstrable to any one who will take the trouble to look into it. One of the latest contributions to the literature of the subject is a work entitled *The Physiology of Bodily Exercise*,* by an eminent French writer, Dr. Lagrange; a treatise in which the scientific aspect of the matter is exhaustively dealt with, and to which we are in a great degree indebted for the facts and propositions set forth in the following chapter.

* *International Scientific Series.* Kegan Paul, Trench & Co.

CHAPTER II.

THE PHYSIOLOGY OF EXERCISE.

THE immediate agents in the movements of the body are the muscles; bundles of reddish fibres which form the fleshy masses surrounding the different parts of the skeleton. These bundles are usually of an elongated shape, tapering downwards from the centre, and terminating at either end in a tendon attached to a bone. Every muscle possesses the property of contracting, and when it contracts it exercises more or less tension on the bones to which it is attached. In shortening, it grows larger, particularly towards the centre, as would a stretched mass of india-rubber of similar shape on reverting to its former condition.

The necessary impulse is given to the muscle by the *Will*, conveyed through the medium of the *nerves*. The quality which causes the muscle to answer to such impulse is known as its *irritability*. The majority of muscles, or sets of muscles, are in pairs, so to speak, the one having the precisely opposite action to that of the other.

Thus the muscles which bend a limb, known as *flexors*, are balanced on the opposite side of it by others which straighten it, known as *extensors*, and these two sets of muscles are relatively said to be *antagonistic*. To preserve due harmony of shape, strength and activity, both sets should receive equal employment. Each such set of muscles forms a check upon the other, and their due *co-ordination* is necessary to precise and easy movement. In some instances such co-ordination is instinctive; in others (as in the case of the pianist, bringing down his fingers in rapid succession on precisely the right keys) it is only acquired by long habit and practice. Perfect co-ordination is the foundation of grace and dexterity; the lack if it produces clumsiness and awkwardness.

Whether a given movement be well or ill-performed, the mere fact of such movement of necessity gives rise to certain chemical phenomena within the body. The circulation is quickened; in other words the blood flows with greater rapidity, and this not merely through the substance of the particular muscle used, but in a modified degree through the whole of the circulatory system. "It is a vital law," says Lagrange, "that every organ in activity draws towards it a greater quantity of nutrient fluid than it does when in a state of repose." It is equally a law that "the nutrition of an organ is in proportion to the quantity of blood

which passes through it;" hence the fact, familiar to all, that the limb which does the largest share of work—the arm of the blacksmith, the leg of the pedestrian,—is more fully developed than the other members of the same body, or the corresponding members in persons of different occupation.

But this local development is only *one* of the salutary effects of exercise. The increased demand of the active organ causes, as we have seen, greater activity in the whole of the circulatory system. Nor is the heart alone concerned. A greater volume of blood being driven to the lung, this organ in turn becomes more active. A fuller supply of oxygen is drawn into the system, and, under the new impulse thus imparted, those mysterious processes of *combustion* on which our life depends are made more rapid and more complete.

For there is a strange phœnix-like process perpetually at work in the human body. In the words of the late Archibald Maclaren, the pioneer of scientific gymnastics in England:—"Our material frame is comprised of innumerable atoms, and each separate and individual atom has its birth, life, and death; and then its removal from the place of the living. Thus there is going on a continuous process of decay and death among the individual atoms which make up each tissue. Each atom preserves its vitality for a limited space only, is then separated from the tissue of

which it has formed a part, and is resolved into its inorganic elements, to be in due course eliminated from the body by the organs of excretion. These processes are greatly influenced by the activity of the bodily functions. Every operation of the muscles or nerves involves the disintegration and death of a certain part of their substance. We cannot lift a finger, we cannot perform the slightest movement, without causing a change in certain of the atoms which compose the muscles executing the movement, in those of the nerves conveying the stimulus which directed them to contract, and in those composing the nerve-centres in which the stimulus originates,—and this change involves their decay and death.

"The loss then of the body, and of each part of the body, being in relation to its activity, a second process is necessary to replace the loss, otherwise it would rapidly diminish in size and strength, and life itself would shortly cease. This reparative process is performed by the nutritive system, the organs of which convert our food into blood—liquid flesh (*chair coulante*) as it has been called—which in itself contains, and in its never-ending circulation bears to each tissue, the material for the replacement of all waste and for the building-up of all additions. And as this material is borne along through channels permeating every part of the organism, each part, by a

law incomprehensible but unerring, selects from it and appropriates that particular *pabulum* which is fit for its special use, and that only. At every point of the human body is this law in unceasing operation—activity, a loss of vital power, disintegration, decay, and removal—to be met by a replacement of substance and a renewal of vital power. And as the disintegration of any part is hastened by its activity, so by an equally unerring law is the flow of blood, bearing the renewing material, increased in that part; and again by a law equally unerring and ever operative, the worn-out particles are cast into this current in its backward course, and conveyed to organs whose function it is to eliminate them from the body. . . . . And the strength of the body as a whole, and of each part of the body individually, is in relation to the frequency with which these atoms are changed; and the strength of the body as a whole, and of each part of the body individually, is thus ever in relation to its newness.

"Exercise, then, as we have seen, is the chief agent in the destruction of the tissues; but it is also the chief agent in their renovation, inasmuch as it quickens the circulation of the blood, from which the whole body derives its nourishment; the tide on which is brought up all fresh material, and on which is borne away all that is effete and useless, brought up and borne away most rapidly

in those parts which are being most rapidly employed, where disintegration is most rapidly taking place." *

We have given this quotation at length, as indicating in a clear and precise manner the way in which bodily exercise tends to conserve and increase *strength*, but it has yet to be shown that it operates in an equally marked degree on the conservation and increase of *health;* and conversely, that the lack of exercise tends to lower the standard of vital energy. This arises from the fact that the chemistry of nature, given a sufficient amount of the needful *pabulum* in the shape of food, is not content with maintaining a mere balance in the system, but is constantly accumulating what are known as "reserves," consisting partly of fat, partly of a sugary substance called *inosit*, and partly of nitrogenous products, deposited in the substance of the tissue. The combustion of the two former is the main source of the force employed in muscular movement, and so long as, by regular exercise, they are kept neither above nor below the normal limit, all is well. Should such reserves, by excess of work, or deficiency of nourishment, become exhausted, the combustion produced by exertion

* *A System of Physical Education, Theoretical and Practical.* Clarendon Press.

is effected at the expense of the essential tissue of the organs themselves. Under such conditions the machine after a little while wears itself out, and the patient dies.

But in a far larger number of cases the reserve materials are in excess, and the system is clogged by its own waste. As George Herbert quaintly says of the moral nature,

> "Man is no star, but a quick coal
> Of mortal fire:
> Who blows it not, nor doth control
> A faint desire,
> Lets his own ashes choke his soul"—

In like manner with the physical organization. The process of combustion, to which we have adverted, is at work from the cradle to the grave. But it is for man himself to "blow the fire," and this is to be done by bodily exercise. Exercise, by quickening the circulation, sends a fuller supply of blood coursing through the arteries and veins. Exercise, by stimulating respiration, charges the blood with fresh oxygen, which the heart forthwith despatches through the circulatory system to its allotted function of burning up the excess of reserve material.

But the fact of combustion alone is not sufficient. Combustion is never absolutely perfect, but always implies some form of inorganic residue. The most important of these residues

in the present case are carbonic acid, urea, and lactic acid. The former passes off through the lungs, the second through the kidneys, and the third through the skin; while many others, as to which our knowledge is less definite, pass away partly through the above organs and partly through the intestines. Given regular and sufficient exercise, each of these organs does its work without discomfort or disturbance, and maintains the system in a condition of hygienic equilibrium. But if, by too long continued inactivity, the reserves are allowed to accumulate to an abnormal extent, the waste occasioned even by very slight exertion is in excess of the power of the excretory organs to eliminate it, and the patient suffers by such non-elimination in a variety of ways. The tissues, over-rich in carbon, generate under exercise an excessive quantity of carbonic acid. This in ordinary course is conveyed by the blood-vessels to the lungs, to be thence worked off by respiration, but the quantity is here so large, that the lungs—even were they of normal vigour and expansive power —would have great difficulty in making excretion keep pace with production. But the lungs in such a case are of by no means normal power, seeing that under the conditions of sedentary life they are hardly ever expanded to their full capacity, and one-half their air-cells remain

habitually contracted, taking absolutely no part in the act of respiration. When a sudden call arises for a full and deep inspiration, these air-cells, having lost their elasticity by disuse, cannot respond to it. There is a further impediment in the shape of the chest itself, which from the same cause has become narrowed and sunken. As a natural result, the slightest unaccustomed exertion, such as walking quickly upstairs, or running a few paces to catch an omnibus, is sufficient to cause a painful attack of breathlessness, and not unfrequently a dangerous strain upon the heart, enfeebled in like manner from the same cause, *viz.* that it has never been stimulated by exercise to regular and vigorous action. It is noteworthy that this condition of breathlessness is more readily provoked by exercise of the *lower* limbs. This, which at first sight seems an anomaly, arises from the fact that the muscles of the thighs and legs are the largest and bulkiest of the whole body, and consequently throw off in action a larger quantity of carbonic acid.

The same movements less quickly executed do not cause the same amount of distress. This is because the generation of carbonic acid is in such case slower, and time is given between each movement for the lungs to throw off the quantity conveyed to them by the blood-vessels.

But even supposing the unaccustomed exercise

to be of a nature which does not produce this particular form of distress, any one "out of condition," as it is termed, is still liable to many other inconveniences, some of which may take a very acute form. A familiar example is found in the case of the man who, without any previous training, leaves his desk and starts off for a walking or cycling tour. He may so regulate his pace as to feel no immediate distress either of lungs or heart, but after his first day's work (unless it has been extremely small), he will find that, although very tired, he cannot sleep but by fits and snatches. His head aches, his skin is hot and dry, his mouth parched, his whole body full of fever. The next day he gets up stiff in every limb, so that fresh exertion is a positive pain to him. This means that the unaccustomed exercise has charged the blood with other forms of waste in the shape of lactic and uric acid. If he perseveres in his unaccustomed toil, one of two things happens, according to the greater or less amount of his present exertion, and the degree in which he has debilitated himself by previous inactivity. If he has not sunk too far below par, and his present exertions are moderate in degree, the stiffness and other discomforts will gradually pass off by the elimination of the disturbing elements; and he will find himself able to attempt even harder work without inconvenience. In other

words, he is gradually getting into "condition.' In the opposite case, he will be pulled up short by a sharp attack of gout or rheumatism. And this state of things unfortunately tends to perpetuate itself. The inactive man finds himself in a vicious circle, from which it is extremely difficult to escape. He has continued so long in his habits of sloth, that the effort to break through them is a positive pain to him, and the longer he so continues, the greater the difficulty becomes.

Nor is he exempt, though he avoid all active exercise: Nature is not to be eluded. If her laws are outraged, she will exact the penalty; if not in one way, in another. Gout will find out the self-indulgent man, though he never stir from his easy-chair. Meanwhile, a host of lesser evils, impaired appetite, indigestion, sleeplessness, nervous irritability, not to mention the many forms of liver and kidney disease; indeed, half "the ills that flesh is heir to" lie in wait for the man who, from carelessness or indolence, fails to make due use of the bodily powers with which his Maker has endowed him.

It would be easy to go much more deeply into this hygienic side of the question, but to do so would be out of place in a popular manual. Any reader who desires more ample information as to this aspect of the matter, will find it discussed in the fullest manner in the treatise of Dr. Lagrange

already mentioned.* We have, however, said enough to enable us to claim as a postulate what is really the text and *raison d'être* of this little book, viz. that *a sufficiency of bodily exercise is a necessary condition of healthy life.*

It will however be well, before we pass away from this branch of the subject, to say a few words as to the nature and causes of the special pain which follows continued exertion, and which we call *fatigue.* The function of fatigue is clear; it is the danger signal against over-exertion. So long as bodily exercise is kept within due limits, *i.e.*, in due proportion to the strength of the subject, fatigue is but transitory, and on the cessation of exertion, speedily disappears. This form of fatigue arises simply from the blood being, as we have seen, temporarily charged with carbonic acid beyond the power of the lungs to eliminate it, and from the heating of the blood, (also a necessary consequence of work) producing a depressing effect upon the nerve-centres.

But if the warning be disregarded, and the exercise taken be relatively either too long or too violent, fatigue does not come to an end with the cessation of the exercise which caused it, but continues in a more or less acute form, for a considerable period. The circulation of the blood

* See p. 7.

falls back to its ordinary rate, the production of carbonic acid is stayed, and its excess excreted by the lungs, while the temperature sinks down to or below its normal level, and yet the sensation of fatigue, in this case known as *consecutive fatigue*, continues. There is a sensation of fever, prostration, general discomfort. These symptoms arise from the formation of the waste-products to which we have already adverted,* with which the blood is now charged, and which produce a condition of what is medically known as "auto-intoxication," or self-poisoning, and this continues until these waste products are little by little carried by the blood to the kidneys, and thence eliminated from the system. Hence the persistence of consecutive fatigue. Nor does the mischief always end here. If the waste products are too abundant, or the resisting power of the organism insufficient, these noxious substances give rise, by a process of which we are ignorant, to other similar substances, which renew themselves in the blood during many days, and give rise to the fevers of over-work.†

* See p. 15.

† Lagrange, *Physiology of Bodily Exercise*, p. 166. The same writer quotes two cases of pseudo-typhoid fever (so called from its close resemblance to actual typhoid) arising from this cause. Both patients were young men; the one an enthusiastic fencer, had spent six hours daily with the foil in his hand; while the other had exercised four hours daily on the horizontal bar. Dr. Lagrange further notes that the occasional outbreaks of typhoid in the army are usually

The foregoing explanation shows the reason why the inactive man is so much more readily fatigued, and remains so so much longer than the man who leads an active life. In the latter case the waste-products are habitually and regularly eliminated from the system. In the former they accumulate, lying quiescent in the inactive muscles till some unaccustomed exertion throws them into the blood, and produces the auto-intoxication, or self-poisoning, to which we have referred.

The moral is two-fold ; first, that the man who values his health should not allow these insidious foes to increase and multiply in his body, as they surely will, unless he declares habitual war against them ; and secondly, that if they have unhappily gained a footing, a wise caution must be exercised in the process of their expulsion, sudden and violent measures tending to produce an even worse condition than that which they are designed to remedy.

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traceable to spells of general over-work. The researches of other scientists have discovered that there is found in the blood in such cases a specific poison, known as *muscarin*, closely resembling the poison extracted from certain kinds of *fungi*.

CHAPTER III.

THE VARIOUS FORMS OF EXERCISE.

THE need of exercise, in some form or other, having been established, the next question for consideration is "What form should such exercise take?"

The most popular forms of exercise, as such, at the present day, are as follows :—

Walking.
Riding.
Cycling.
Running.
Boxing and fencing.

To these must be added various out-door games, such as lawn-tennis, cricket, and foot-ball.

Each of these has its special recommendations, and each finds champions, who are prepared to maintain its virtues against all others. In truth, all are good, but neither perfect as a means of exercise. In the words of Maclaren, "There is no single exercise invented or inventable by man, which gives employment to more than a part of the body, and to a very small part too,

when closely examined."* Let us take walking, for instance. The value of walking as a gymnastic exercise, is sufficiently evidenced by the fact that the oarsman training for a race, or the boxer for a pugilistic encounter, makes it part of his daily work, as one of the chief means of getting into perfect condition. But walking, to be effective, must be done as the rower or boxer does it, not at an idle saunter, but at a smart, springy pace of not less than four miles an hour; and if walking is the only exercise, not less than *nine miles a day* should, according to the best authorities in hygiene, be regularly covered to keep the experimenter in good condition. Further, the exercise of walking tends to develop mainly the muscles of the lower limbs, which, under almost any circumstances, get the larger share of work. The chest, (if the walker attends to position)† profits by the greater amount of work given to the

* *Training in Theory and Practice*, p. 21.

† Much of the value of walking, as an exercise, depends upon the position maintained by the pedestrian. This should be as follows: Head up, chest forward, arms down, shoulders squared. Further, each step should be with a distinct and unmistakable pressure on the ball of the foot as it leaves the ground. This habitual pressure tends more than anything to develop and strengthen the muscles of the calf and front of the thigh, and to make a really good walker. The acquisition of the habit will be found a little fatiguing at first, but once acquired, the pedestrian will be astonished with the ease and speed with which he covers the ground. The pressure referred to should not be enough to *lift* the body in any perceptible degree, but just sufficient to impel it forward.

respiratory organs, but the muscles of the arms and shoulders gain little or nothing; and the same may be said of cycling, which, delightful and health-giving as it is, at best only employs a portion of the muscles, and in some cases, from the crouching, round-shouldered position foolishly adopted by the rider, is absolutely prejudicial to the development of the upper part of the body. There is another danger incidental to cycling, in the temptation to attempt distances or rates of speed in excess of the strength of the rider. An eminent authority, Dr. B. W. Richardson, gives a typical example. "A gentleman, seventy-eight years of age, has started a tricycle. He finds, to his intense surprise, that he can ride from Brighton to Lewes without fatigue; that is about eleven miles. In a few days he discovers that he can go there and back in one day, without fatigue. A few days later he tries to do the same distance against time. He can do it in four hours. But there is a young fellow he knows (who, by the way, is only sixty years younger) who can do it in a little over two hours. Why should he not come near to that mark also? It is a mere matter of practice and skill. So he does his best, and having no elastic tissue left in him, fitted to give his lungs and blood-vessels due elasticity, he finds himself jarring all over. . . He cannot get over the 'jolting' for a month,

and dates a good deal of mischief from the jolting."

In such a case the verdict of most people would be that the elderly cyclist was deservedly punished for his folly. But the incitement to over-exertion may come in much more subtle forms. The cyclist goes a few miles out of his way; his goal is further off than he anticipated; the roads are bad and his labour thereby doubled, but he is bound to get home, and by the time he does so, he may find that he has done thirty, forty, or fifty per cent. more work than he had intended. Even to the most moderate rider, there is another risk attendant on cycling, the extent of which few people appreciate. We allude to the frequently recurring temptation to ride a hill too steep or too long for the strength of the rider. As to this we have already, writing as a cyclist for cyclists, sounded a gentle note of warning. "No cyclist should shirk a hill *fairly within his powers*, for it is by steady perseverance in the face of difficulties that powerful riders are made; but so soon as the cyclist finds that he cannot proceed without actual distress, and in particular if he is conscious of undue strain upon the heart and lungs, he should at once dismount and walk, pushing his machine before him. And in this matter each must be the judge for himself. The fact that A is able to mount a given hill

is not the smallest reason that B, perhaps two stone heavier, and mounted on an inferior machine, should be able to do so likewise, and if he persists in making the attempt, he may have grave reason to regret it."*

Dr. Herschell, in the little book to which we have already adverted,† after referring to the dangers of racing, gives a similar warning. "The rider must carefully avoid the temptation which is always present, of *rushing the last few yards in climbing a hill.* More weak hearts are permanently damaged by this than most people imagine. You are climbing a hill, you are near the summit, a few more strokes are all that are required to enable you to surmount it. But these last few strokes are harder work than any which have preceded them; your heart's action is already most probably accelerated, and the extra strain thrown on the overtaxed organ frequently produces serious injury."

It will be obvious that these dangers arise from *abuse* of the sport. But it is equally clear that, in estimating the therapeutic value of cycling, these possible dangers must be taken into consideration. It must further be remembered that, during a large part of every year, cycling is impracticable for any save the hardiest of riders.

* *Tips for Tricyclists* (Warne & Co.).

† *Health Troubles of City Life.* See p. 2.

Horse exercise, though a capital stimulant for the liver, and furnishing sharp work for several sets of muscles, still leaves a large number unemployed. That neither boxing nor rowing, taken alone, affords adequate all-round exercise, is sufficiently proved by the fact, to which we have already adverted, that walking or running forms an essential part of the accepted training of the boxer and the oarsman. Rowing is subject to another drawback, in the fact that, like the "grasshopper" style of cycling, it tends to contract the chest. Indeed, it is at best but a partial exercise. The enthusiastic oarsman may deny this, but the fact is admitted by the best authorities on gymnastics. "Rowing," says Maclaren, "gives employment to a portion of the back, more to the loins and hips, and most of all to the legs, but it gives little to the arms, and that little chiefly to the fore-arm, and least of all to the chest. . . . The legs have strong employment in rowing, but it is the *extensor* muscles alone which have actual employment; the *flexors* are comparatively idle; they perform no exercise, they gain no bulk, they obtain no increase in power."* The American writer, Blaikie (*How To Get Strong*, p. 232), testifies to the same effect:—

"Rowing," he says, "taken as substantially one's only exercise, as is too often the case with

* *Training in Theory and Practice*, pp. 18, 19.

rowing men, brings a partial and one-sided development, making the parts used look too large for the rest, the fact being that the rest have not been brought up as fast as the former. Unless one's chest is unusually broad and strong, and often even if it is, constant rowing warps his shoulders forward, and tends directly to make him a round-shouldered man, while the upper arm, or that part above the elbow, has had practically no development, the inner part of the *triceps* or back arm alone being called to severe duty, but the bulk being almost idle."

Fencing and lawn-tennis, both admirable exercises in their way, share the drawback that they tend to develop unduly one side of the body to the exclusion of the other, the left arm and shoulder getting by no means their due proportion of exercise. Fencing, indeed, if indulged in to any considerable extent, has a tendency to produce lateral curvature of the spine, known as *fencer's scoliosis*.

Cricket and football need hardly be discussed in the present connection. As recreation for the young, they have their value; somewhat discounted in the case of cricket by the long intervals of inactivity, and in that of football by the many risks of accidental injury, but no one would seriously put them forward as adequate forms of daily gymnastic exercise.

It will have been noted that in each one of the recreations we have mentioned, a part only of the muscular system comes into active operation. But there are further difficulties in the way of their regular employment as hygienic exercises. Fencing, boxing, tennis, all demand an antagonist, and an antagonist is not always available. Walking, riding, and cycling, are each "slow" without a companion; and further demand a considerable daily expenditure of time, if they are to be made really valuable in a hygienic sense. Cycling, in addition, demands for its proper and safe enjoyment, a complete change of costume before and after the exercise, and the extra time thus occupied is in itself a consideration to a busy man. In a word, the sports we have named, though each delightful in a recreative and valuable in a hygienic sense, fail to "fill the bill" as complete and adequate means of daily exercise. For, be it remembered, to the maintenance of perfect health two requirements are necessary. The exercises must in the first place be so contrived as to give due employment to every part of the body, and secondly, they must be taken in gentle doses, but *with unfailing regularity*. Half an hour of quiet easy work, repeated daily for a week, will do certain and unmistakable good, while the same amount of exercise crowded into a single afternoon would, in the case of

a person out of condition, just as certainly do harm.

How then is this needful daily stimulus to be procured? It is clear that it must take a form which shall be always available, involving neither serious loss of time nor any special exertion outside the exercise itself. These conditions bar in the majority of cases the use of the public gymnasium, which is further excluded by the fact that the majority of the exercises there practised are both too violent and too difficult for the class for whom these pages are mainly intended, the class, namely, to whom health, rather than strength, is the chief object of desire. Maclaren has some pregnant remarks on this subject. "It is *health* rather than *strength* that is the great requirement of modern men at modern occupations; it is not the power to travel great distances, carry great burdens, lift great weights, or overcome great material obstructions; it is simply that condition of body, and that amount of vital capacity, which shall enable each man in his place to pursue his calling, and work on in his working life, with the greatest amount of comfort to himself and usefulness to his fellow men. . . . Very closely are health and strength connected, but they are not the same, and a man may possess either without the other. For strength may be due to the great force possessed by one system of the

body, such as the muscular; or great force in one part of the body, such as the trunk or the limbs; but health is the uniform and regular performance of all the functions of the body, arising from the harmonious action of all its parts—a physical condition implying that all are sound, well-fitting, and well-matched. Young minds do not look far enough into life to see this distinction, or to value it if seen; they fix their eyes longingly upon *strength*—upon strength *now*, and care not for the power to work long, to work well, to work successfully hereafter, which is *health*. Therefore it is fortunate that the same means which usually give strength give health also; although the latter may be jeopardised by irregular efforts to maintain the former."*

Far be it from us to disparage physical strength, or to undervalue the exercises of the gymnasium. Indeed, we hold that education, to be complete, should include a two years' course of thorough gymnastic instruction, and that without having undergone such a training, no young man or young woman is fully equipped for the battle of life. But when middle life is reached, it is too late to begin such a course. The body has gained in weight what it has lost in elasticity, and the exercises which are sport to the lad of twenty,

* *Physical Education*, p. 24.

would be a trial, not to say a danger, to his middle-aged progenitor.

Fortunately, however, the difficulty is easily got over. By the aid of one or two simple and inexpensive appliances *scientifically used*, the man of mature years may obtain all the exercise which health demands in his own dressing-room or study. The nature of such appliances, and the conditions under which they can be employed to the best advantage, will be discussed in later chapters.

CHAPTER IV.

HOW AND WHEN TO EXERCISE.

THE *time of day* at which Home Gymnastics are practised is by no means unimportant in a hygienic sense. The *best* time, in our own opinion, is immediately on rising in the morning. One advantage of selecting this particular time is that it does not interfere with the other occupations of the day. The busiest man can, by rising that much earlier, "make time" for half an hour's gymnastic exercise in his bed-chamber or dressing-room. If the neophyte finds, as he may do at the outset, that even light exercise before breaking his fast produces a sinking or exhausted feeling, there is no objection to his munching a biscuit or a crust of bread beforehand, but it will be found that this is very much a question of habit, and if he can dispense with it, so much the better. A brief spell of exercise the last thing before retiring to rest is also valuable, but in this case it should be limited to ten or fifteen minutes, so as to stop just short of fatigue or perspiration.

If, unhappily the patient is too indolent to take

the needful exercise before breakfast, and too fagged at the close of the day to take it before retiring to rest, any other hour may be selected, subject to the qualification that it should not be in any case *less than two hours after a meal*, and a still longer interval is advisable. For a considerable period after eating, the blood is impelled toward the stomach to aid in the work of digestion, and if it is diverted therefrom to the muscles (which, as we have seen, is the natural effect of exercise) the process of digestion suffers, and dyspeptic troubles are likely to be the result.

There is a special convenience in the selection of the early morning as the time for exercise, in the fact that it is in such case naturally and conveniently followed by the morning bath, which forms its hygienic complement. With regard to the precise form the bath should take, much will depend on individual taste and habit. A young and vigorous man may plunge with impunity even into ice-cold water. An older man, of less active circulation, indeed any man who has passed thirty-five or forty, will do wisely to take "the chill off" before he ventures on his dip. Of late years medical men are chary of advising complete immersion even in the tepid bath as freely as they were wont to do, and in cases of nervous exhaustion or lack of tone, recommend the "rub-down" bath in preference. This, which we

regard as *the* bath for the gymnast, is taken as follows :—

The bather, standing in a few inches of water, warm in winter, tepid or cold in summer, rubs himself vigorously all over with a pair of wetted flesh gloves. The body should be dried with a rough towel, and then again rubbed with a pair of dry gloves. The gloves used for the purpose may be either Cash's Patent (made of unbleached woven tape), or those known as the *Knotted Calefacio*,* both procurable of any chemist. The latter are, however, only suitable for *dry* rubbing. In any case each pair of gloves (wet and dry) should be used for its own purpose only, and both gloves and towels should be of flax, not cotton, the latter material losing its "tooth" too quickly. Many for wet rubbing prefer the oriental "loofah," which may be used either in its natural condition—simply split open—or made up into regular rubbers, with a strap across the back wherein to thrust the hand.

The chief point about the rub-down is that it should be *energetic*; the friction hard enough to redden the surface of the skin, and every limb receiving its due share of attention. As a complement to the previous exercise, its effect is

* The surface of this glove is divided into minute squares like those of a chess-board, of same colour, but rough and smooth alternately.

remarkable. All sense of fatigue disappears as if by magic. The skin is no longer moist with perspiration, but glows with a genial warmth. The head feels clearer, the spirits lighter, the whole body full of energy for the coming day's work. A weekly Turkish bath is a very excellent thing, as keeping the skin thoroughly "clean" and its pores free from obstruction, but it by no means takes the place of the morning rub-down, neither is it of the smallest use (as some suppose) as a cure for obesity. There is naturally a slight loss of weight during the process of the bath, but unless such loss is maintained by intentional abstinence from liquids afterwards (a very unwise proceeding), the lost weight will be regained in the course of a few hours.

Reverting to our more immediate subject, it may be well to say a word or two as to the *clothing* most suitable for the practice of Home Gymnastics. The ancient Greeks were wont to perform their athletic exercises, in the words of Hans Breitmann, "mit nodings on," * and where climate and other conditions admit, this is undoubtedly the ideal costume for the gymnast. Such a costume, or lack of costume, would be inadmissible for obvious reasons among ourselves, but it is well to get as near it as circumstances permit. In

* Hence the term "gymnastics," from γυμνὸς, naked.

other words, the clothing should offer the least possible obstruction to the movements of the body, and the least possible impediment to free circulation of the air around it. These conditions are fairly met by the ordinary gymnastic dress, consisting of low-heeled canvas shoes, flannel trousers, secured by a belt at the waist, and a tight-fitting jersey. The only point which might be improved upon in a hygienic sense, is the latter item, which should be woollen, and not cotton, as is usually the case, the former material being more favourable to free transpiration, and involving less liability to chill. Cyclists have long since discovered that woollen is "your only wear" for exercise involving copious perspiration, and the sooner gymnasts recognise the same principle, the better it will be for them.*

The home gymnast is, of course, not restricted to the conventional garb of the gymnasium, but may adopt any costume he pleases. In the solitude of his own chamber, he may even revive

* The only *cotton* material which can safely be used by athletes is that of the *Cellular Clothing Company*, 124, *London Wall*. This, from the peculiar manner in which the fabric is woven, (forming a kind of network, enclosing minute air-cells) has most of the virtues of all-wool, with sundry advantages of its own. It allows the free escape of the exhalations of the body, while the air enclosed in the fabric maintains an equable temperature around it. It is much less expensive than all-wool, and is free from the liability to shrink in washing, which is so serious a drawback to woollen garments.

the traditions of ancient Greece, or without going to this extreme, a flannel shirt and drawers, or the pyjama suit, now gradually creeping into popular favour, will be found a very satisfactory athletic costume. If the reduction of weight is a special object, a woollen "sweater" may be worn in addition, but anything in the nature of coat or jacket should be avoided, as tending to interfere with perfect freedom of movement.

It is essential that the room in which the exercises take place should be *freely ventilated.* As has already been pointed out (p. 10) a great part of the benefit of exercise arises from the quickened circulation and more perfect oxidation of the blood. To render such oxidation complete, an ample supply of oxygen is needful, and this is only to be obtained by allowing free ingress to the external air. Consequently (*verbum sap.*), keep your windows open when practising.

With regard to the *duration* of the daily exercise, no hard and fast line can be laid down. In the early stages of practice it is better to err on the side of doing too little than too much. *Chi va piano va sano,* and the proverb has no more fitting application than to gymnastic exercises. A total of ten minutes will be enough to begin with, and this total should be divided between various exercises, so as not to unduly fatigue any one muscle, or set of muscles. At

this early stage, the repetition of a given movement ten times will be found quite sufficient; to be gradually increased, as practice brings facility, to fifty times, which, unless the development of some special muscle is sought, will in most cases be found a sufficient *maximum*. Rather than continue a given exercise beyond this point, it will be found better to increase the number of exercises, so as to obtain a wider range of effect. Professor Dowd recommends the daily exercise to be continued for an hour, and if a high degree of general muscular development be aimed at, this is not too much; but if health alone is sought, and strength, as such, made a secondary consideration, a full half-hour each morning will usually be found sufficient.

It should however be borne in mind that, to gain the fullest hygienic benefit, three effects should be produced. At the close of the morning's task the patient should be slightly fatigued, a little out of breath, and gently perspiring. If the suggested half-hour's work does not produce these effects, either the time should be increased, or more energy put into the work. Five to fifteen minutes may be beneficially employed in the same way just before retiring to rest, but in this case the exercise should be more gentle, stopping just short of the three effects we have mentioned.

CHAPTER V.

THE MUSCLES OF THE BODY.

THE first step towards an intelligent appreciation of the exercises we are about to describe, will be to gain an elementary knowledge of the muscular system, and such knowledge may be very readily attained by a careful study of the two plates at the beginning and end of this volume, representing respectively a front and back view of the celebrated *Ecorché* of Houdon.

We must premise, for the information of the non-scientific reader, that space will only permit of our dealing with the principal muscles; the total number being far too large, and their relations too complicated for explanation in a popular manual like the present. The muscles of the head alone, exclusive of the neck, are about forty in number, even so little mobile an organ as the nose having no less than fourteen (seven on either side) employed in its service. When we consider the almost infinite varieties of movement of which the human frame is capable, and

that so small an act as picking up a pin employs, more or less, muscles in every part of the body, we cease to wonder at the complexity of its mechanism. With the minor muscles, however, we have, for our present purpose, no concern.* Many of them, indeed, are but subdivisions or branches of larger muscles, their function being to modify, in some special manner, the effect of the contraction of the main body. These gain incidental development from the exercise of the larger muscles, and with the latter alone, therefore, it will be needful here to deal.

Beginning at the neck, we have (1), the *Sterno-cleido-mastoid* muscles, one on either side. These, working in opposition, move the head from side to side; in conjunction, they tilt it forward. A little more to the rear of the neck, but hidden by the *Trapezius* (hereafter referred to), behind which they pass perpendicularly downwards, are the pair of muscles known as *Levatores Anguli Scapulæ*, which lift the shoulder-blades in the act of shrugging the shoulders. Covering the shoulder, we have (2) the *Deltoid*, so called from its triangular form, which gives it a fanciful

* Professor Dowd gives exercises even for developing the contour of the face—for filling out a hollow cheek, and improving a defective smile. Into these regions we have not ventured to follow him. Even he, however, only deals with but a small part of the total number of muscles.

resemblance to the Delta (Δ) or Greek D. This muscle consists of three masses or divisions, with different attachments, and serves to raise the arm, either straight up above the head, or to the front or rear, according as one or the other portion of the muscle is in more active contraction.*

Covering the upper part of the chest, we have (3) *Pectoralis Major*, the great pectoral muscle. It will be seen that the muscle on either side is fan-shaped, tapering to a point at its junction with the shoulder. This muscle draws the arm across the chest, either horizontally, or above or below the horizontal plane, according as the middle, higher or lower portion of the muscle is in the more active operation.† In connection with this, may be mentioned *Pectoralis Minor*; a smaller muscle, which depresses the point of the shoulder, and raises the ribs in forced inspiration.

Passing to the arm, we have, in front of the upper arm (4) the *Biceps Cubiti*, more shortly

* It follows, that to give this muscle its fullest possible development, it must be duly exercised in all three directions. The same principle applies wherever a given muscle has a double or alternative function.

† The motive power of the flight of birds is derived from this muscle, which in their case attains an extraordinary degree of development. The *pectorales* of the swallow, for instance, are said to exceed in weight all the other muscles of the bird taken together.

known as the *Biceps*, which co-operates with (5) *Brachialis Anticus* to flex the arm at the elbow, while (6) the *Triceps* and its continuation beyond the elbow (*Anconeus*) extend the fore-arm.*

Passing now down the front of the fore-arm, we have—

(7) *Supinator Radii Longus.*

(8) *Pronator Radii Teres.*

These are antagonistic muscles, the *Supinator* turning the palm upward, while the *Pronator* turns it downward.

(9) *Flexor Carpi Radialis.*

(10) *Flexor Carpi Ulnaris.*

These two muscles serve to flex the wrist, while (11), *Palmaris Longus*, assists in flexing the wrist and elbow, and makes tense the palm.

(12) *Flexor Pollicis Longus*, as its name denotes, flexes the thumb, while (13) *Flexor Sublimis Digitorum* performs the same office for the fingers.

Passing round to the back of the arm, we come upon a group of *Extensor* muscles, as under—

* It should be noted that the muscles which *bend* a limb (*flexors*) will be found on its inner side; all muscles which extend a limb, (*extensors*) on its outer side. The remembrance of this fact will be of material aid in tracing the position of a given muscle on the diagram. The reference number indicates the position of the body or thickest part of the muscle, but it may take its origin at some distance from this point. Thus many of the muscles shown as in the forearm really originate at the shoulder.

(14) *Extensor Pollicis*—extending the thumb.

(15) *Extensor Communis Digitorum*, extending the fingers.

(16) *Extensor Carpi Radialis*, and

(17) *Extensor Carpi Ulnaris*, extending (i. e., bending outward), the wrist.

Returning now to the trunk: below the armpit, and covering the upper ribs, we have (18) the saw-like muscle known as *Serratus Magnus*, which serves to throw the shoulder forward in the act of pushing or thrusting. In front of the body we have (19) *Obliquus Externus Abdominis*, which co-operates with *Obliquus Internus Abdominis*, and (20) *Rectus Abdominis* to compress the abdominal viscera, and flex the chest on the stomach in various directions.

In the rear of the trunk, we specially note (21) the *Trapezius*, a broad flat muscle in shape not unlike a boy's kite; attached at top to the base of the skull, at its lower extremity to the dorsal vertebræ, and spreading laterally from the vertebral column towards the shoulder-blades. Its function is to draw the head backward and the shoulder-blades together, (thereby expanding the chest); it also raises the shoulders.* The

* There are frequently several muscles which take part in producing or modifying a given movement, but in an elementary

Scalenus muscles, of which there are three pairs (*Anticus*, *Medius*, and *Posticus*), flex the neck laterally, or raise the upper ribs. *Levator Anguli Scapulæ* raises the shoulder-blades, while *Rhomboideus Major* and *Minor* draw them upwards and backwards. (22) *Latissimus Dorsi* (a broad muscle, occupying much of the space between arm-pit and hip) serves to draw the arm downwards and backwards, and to depress the shoulders. If the shoulders be kept rigid, it raises the lower ribs. Crossing this muscle in a transverse direction, but farther from the surface, lies the *Longissimus Dorsi*, antagonistic to the *Rectus Abdominis*, and serving to straighten the upper portion of the spine, while the *Erector Spinæ* and *Sacro-lumbalis* do the same for the lower part of the spine, and hollow the back.* Just behind the upper arm, are (23) *Teres Major*, (24) *Teres Minor*, and (25) *Infra-spinatus*, the former co-operating with *Latissimus Dorsi*, the two latter rotating the shoulder-joint outwards.

Passing downwards, still in the rear, beyond the

sketch of this kind, it is impossible to notice more than those principally concerned. Conversely, many muscles have some secondary function, in addition to that here indicated.

* There are several other muscles which take part in the erection of the spine, but they are mostly deep-seated, and would require additional diagrams to show their position. It is therefore hardly worth while to enumerate them. They will be referred to under the general description of *Erectores Spinæ*.

hip-joint, we have (26) *Gluteus Maximus*, the great muscle which forms the buttock, and whose function is to extend and abduct* the thigh, and rotate it outwards; co-operating also with the *Erectores Spinæ* to keep the trunk erect.

In front of the thigh we have (27) *Rectus Femoris*, (28) *Vastus Externus*, (29) *Vastus Internus*, and *Crureus*,† together forming the mass of muscle known as the *Quadriceps Extensor*, and serving to extend the leg. Whilst the (30) *Pectineus*, helps to flex the thigh, and rotate it outwards. Crossing the front of the thigh in an oblique direction is (31) *Sartorius* ("the tailor's muscle") serving to flex and cross the legs. *Adductor Brevis* (32), *Adductor Longus* (33) and *Gracilis* (34) adduct and flex the leg, while *Adductor Magnus*, a deeper muscle, below *Gracilis*, in conjunction with *Pectineus* (see above) adducts and rotates it outwards.

In the rear of the thigh and antagonistic to the *Quadriceps Extensor*, we have (35) *Biceps Femoris*, which, aided by (36) *Semi-tendinosus* and (37) *Semi-membranosus*, flexes the leg at the knee. 35 also rotates the leg outwards, and 37 inwards.

* To *abduct*, in physiology, is to move a limb in a different direction to that of the axis of the body. To *adduct* is to bring it back again.

† *Vastus Internus* and *Crureus* form practically one muscle only, and are usually treated as such.

The calf of the leg is formed by the combination of three muscles; (38) *Gastrocnemius*, (39) *Soleus* and (40) *Plantaris*—serving to extend the foot, as in walking. The two former unite at their lower extremity to form (41) the *Tendo Achillis*,* making the connection with the heel-bone. (42) *Tibialis Anticus* flexes the ankle-joint, and elevates the inner edge of the foot, while (43) *Peroneus Longus* and (44) *Peroneus Brevis* extend the foot.

The muscles of the foot, serving to flex, extend, abduct, and adduct the toes, are very numerous, but these, for our present purpose, it is hardly necessary to specify.

In addition to the various muscles shown in our illustrations, must be mentioned the *Diaphragm* or *Midriff*, a dome-shaped muscle, lying between chest and stomach, and being the muscle chiefly concerned in the act of inspiration. When the diaphragm contracts, its arch becomes flatter,

* This tendon will under ordinary circumstances bear a direct tension of 1,000 lbs., but is nevertheless very liable to be ruptured by a sudden strain, more particularly in the case of persons past middle life, who have not by regular exercise kept the tissues in good condition. We have known the *Tendo Achillis* snap in the course of a game of lawn tennis. The sensation at the moment is said to be as if the calf of the leg had been struck by a stone. This is followed by absolute powerlessness of the limb, and the only remedy is rest in a recumbent position till the healing power of nature has again united the severed fibres.

and the cavity of the chest being thereby enlarged, air rushes in to supply the vacuum, and so fills the lungs.*

* As already stated the above must be regarded as a mere rudimentary sketch of the muscular system. Many of the muscles lie one above another, and a very large number of diagrams would be needed to shew the position and course of each. Thus *Levator Anguli Scapulæ* and *Rhomboideus Major* and *Minor* (see p. 45), occupy in part the same area as the *Trapezius*, and to have endeavoured to indicate their position by numbers on the diagrams we have given, would have only led to confusion.

CHAPTER VI.

THE DUMB-BELLS AND EXERCISES THEREWITH.

THE appliances of the Home Gymnasium need be neither numerous nor costly. Even a single pair of dumb-bells may be made to serve the purpose. There are more modern and in some respects more effective appliances, which will be discussed hereafter, but a pair of dumb-bells, *properly used*, will afford all the exercise absolutely needful for health, and at the same time produce, with perseverance, a very fair degree of muscular development. But the proper use of dumb-bells is much more the exception than the rule. With a vague idea of improving his *biceps* (the only muscle which is in most cases taken into consideration at all) a man purchases a pair of dumb-bells—usually much too heavy for him—swings them about, without any definite system, for a longer or shorter period, and finding little or no benefit from the process, finally gives them up as "no good." This is the experience of probably nine out of ten self-taught users of the "bells,'

and it is therefore scarcely to be wondered at that they give them up in disgust.

The proper use of the dumb-bells can hardly be called a science, but to be effective it must be based on scientific principles, and if such principles are fairly understood, there is little fear that the exercises will be found uninteresting. If the student is simply told, without any reason assigned, to move his arm in a particular manner, it is not surprising that he soon becomes tired of doing so. But if he has been made to understand

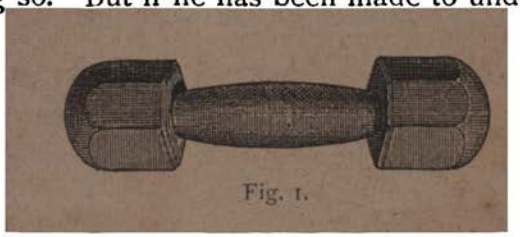

Fig. 1.

that moving the arm in the manner indicated produces an immediate definite effect in the contraction of a given muscle, and that such contraction, repeated sufficiently often, produces other effects, less immediate, but equally certain, in the development of that muscle, and incidentally in the improved health and the better working of his whole frame, the habit of watching for and noting such effects will speedily deprive the work of any irksomeness.

The dumb-bell, in one form or another, has been in use from very remote times. It was known even

to the ancient Greeks, though the dumb-bell of their day differed a good deal in shape from that of our own, taking the forms of a crescent, with its ends either united by a transverse bar, or terminating in round knobs. The annexed diagrams illustrate the most approved forms of the modern

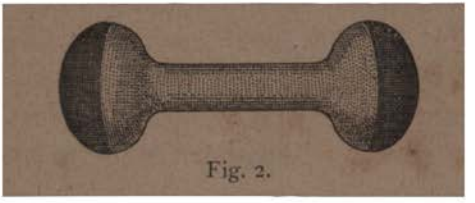

Fig. 2.

dumb-bell, Figs. 1 & 2 in iron, Fig. 3 in polished wood, which for very light dumb-bells (say 2 lbs. and under) is the preferable material.

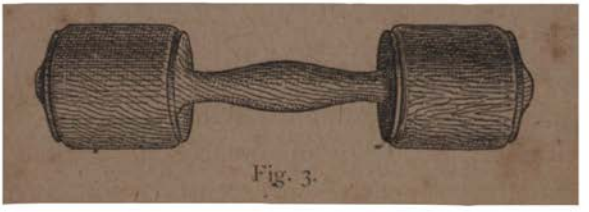

Fig. 3.

The iron dumb-bell (which is the more frequently used) may be either of the bare metal, (as shown in Fig. 1) or covered with leather, preferably cowhide, as depicted in Fig. 2.

In the former case its price ranges from twopence per pound, in the latter it is about six-pence per pound. With the handles alone covered, dumb-bells may be had at three-pence per pound,

or with wooden handles at a slight advance on that price. The naked iron handle strikes somewhat cold to the hands, but in other respects it is immaterial which is used.

The *weight* is a point of much greater importance. Formerly the fashion was in favour of heavy dumb-bells, and gymnasts were accustomed to work with the heaviest weights they could conveniently lift. Muscular development was gained thereby, but it was at the expense of agility, for the movements with such ponderous masses were necessarily slow, and the muscles, accustomed to slow and laborious contraction, became thereby unfitted for rapid movement.* There is a further drawback incidental to the use of very heavy dumb-bells, in the constant liability to "strain." The evils of too heavy dumb-bells being at last recognised, the tide of popular opinion set in the opposite direction, and it became the fashion to use either bells of only nominal

* Some of the more laborious exercises of the gymnasium, if practised to the exclusion of lighter work, have the same tendency. Professor Dowd (*Physical Culture, p.* 48) gives an instance of a pupil who had practised the feats of drawing himself up with the hands to the horizontal bar, and of "sinking" between the parallel bars, till he could perform each an unusual number of times. Both feats belong to the *ABC* of gymnastics, but they involve great muscular effort, as the arms have to lift the whole weight of the body, and the practice of them had made his muscles so slow in action, that he could only strike about thirty blows from the shoulder in the same number of seconds, while an ordinarily active man will strike about three times that number.

weight, or none at all, as in the "free" exercises of the Swedish or "Ling" School, in which the pupil is entirely empty-handed.* We have no desire to undervalue exercises which have unquestionably done much good, and which are still used with advantage, *as preparatory exercises*, both in the army and in the gymnasium, but we cannot resist the conviction that, *used alone*, they represent much waste of time, inasmuch as the same amount of benefit might, by the use of suitable apparatus, be obtained far more quickly. Maclaren puts the *rationale* of the matter very forcibly. "Besides muscular movement, true exercise possesses another ingredient, which may be termed *resistance*. The voluntary muscles are made to do more than merely to move the parts to which they are attached. Man is placed on the earth to labour, to toil, to overcome and to remove material obstacles innumerable. Everything which floats upon the ocean or is built upon the land is the work of his hands—in simple fact has been created by the contractions of his voluntary muscles; these muscles were made therefore not merely to enable him to *move*, but to do this and carry his burden too. They were made in their

* Now largely adopted, and with great advantage, in our Board Schools. We hold, however, that the use of light apparatus would produce effects yet more beneficial. There are some few exercises for which apparatus cannot usefully be employed. These will be separately treated.

action to encounter and overcome *resistance* in every movement; and being created for this, their health and strength will be developed and sustained in proportion to the fidelity with which this their design is remembered and observed. Exercise, which is voluntary labour, must resemble actual labour in all its physical essentials, if it be desired to obtain from it the physical advantages which actual labour bestows. Without resistance there can be no full demand for muscular contraction, no full call for material disintegration; no full requirement therefore for material exercise involving proportionate increase of bulk and power; for, as we have seen, the strength of the body, and of each part of the body, is in relation to its youth or newness."*

The truth that exercise, to be effective, must represent some weight lifted, some obstacle overcome, seems almost too obvious to need serious argument, indeed, it has been acknowledged from the earliest times. "So fight I, not as one that beateth the air," says sturdy old Paul, and the modern

* *Physical Education, p.* 11. There is another advantage in the use of some form of apparatus, from what may be called the moral point of view. There is a feeling of irksomeness attached to all unproductive labour, and unless the experimenter keeps resolutely in view the ultimate goal of his exertions, in the increase of health and strength which will surely if slowly result from them, he is apt to get weary of lifting a weight or pulling a cord day after day, with no immediate gain to show for it. But this "labour wasted" feeling is far stronger in the case of "empty-handed" exercises.

pugilist follows his example. He is not content to spar with an imaginary opponent, but for lack of a better antagonist, will even pummel a sack of bran, and with all the force he can put into the operation. The supposed analogy of walking, running, and dancing,—all exercises of undoubted value,—is sometimes put forward as an argument in favour of free exercises. But the two cases are not parallel, for there is in the exercises above-named a very material element of resistance in the weight of the body itself, which is lifted more or less at every step.

In this, as in most cases, the "golden mean" is the object to be sought. The dumb-bell should neither be so heavy as to preclude rapid and energetic movement, nor so light as to add practically nothing to the work done by the mere movement of the limb. As to the precise weight to be used, authorities differ. Professor Dowd recommends, for a fairly strong man, dumb-bells of five to eight pounds each. The general tendency, however, is at present in favour of the use of much lighter weights, some authorities regarding even two-pound bells as heavy enough for adult use. This is going to the opposite extreme. It should be borne in mind that —given equal strength and condition — the heavier the man, the heavier the weight he can handle without inconvenience. The most satis-

factory rule, in our own opinion, is that the pair of bells, for ordinary use, should weigh approximately one twentieth as much as the user. Thus a twelve-stone man would use a pair of 4 lb. bells, a nine-stone man a pair of three-pounders, and so on. Be it remembered, however, that we are here considering only the attainment of health and *general* muscular development. Where the development of the muscles of the arm is specially aimed at, heavier bells, say up to eight or ten pounds, may be used with advantage, and bells of like weight for certain lifting exercises.

With these heavier bells, however, the movements must be made slowly and deliberately, and as already stated, the tendency of such slow and laboured movements is to increase strength at the expense of agility. Better all-round results are produced by lighter weights and quicker motions.*

Coming now to the consideration of the particular movements to be preferred, we may

* The training of horses furnishes a familiar example. Use a horse for heavy cart-work, and he will develope big powerful muscles, but will never exceed a very moderate rate of speed. If on the other hand you wish to make him a fast trotter, you habitually run him in the lightest trap obtainable. In the case of the race-horse, in which all else is sacrificed to speed, he carries no more than saddle, bridle, and jockey, and the weight of these is reduced to the lowest possible limit. Each animal is what his training makes him. The race-horse can no more do the work of the cart-horse, than the cart horse that of the racer.

remark that the dumb-bell extensions, practised *en masse* in the gymnasium, are by no means equally suitable for home use. These are usually arranged more for prettiness of appearance than with reference to the amount of exercise to be obtained from them. In an approved series of such exercises, which lies before us, the first five consist of the movement known as "twisting" the bells, *i.e.*, making with them a half-turn of the wrist to right and left alternately. The gymnast stands at the outset with the arms hanging down by the sides, and at the word of command twists the bells eight times, first outwards and then inwards towards the body. At the word "change" he is to make a right turn on the heel, bring up the elbows to his sides, and repeat the twisting movement (eight times more) in that position. This done he is to make another right turn (so as to turn his back on the point which he faced at starting), to extend his arms outwards and sideways level with the shoulder, and repeat the twisting movement in *that* position. For Exercise 4 he is directed to make another right turn, raise the arms perpendicularly above the head, and repeat the twisting movement in *that* position. For Exercise 5 he is to make a final "right turn," (bringing him to the position in which he started) to extend the arms horizontally in front of him, and repeat the twisting movement as before.

Such a series of movements, neatly executed by a trained squad (with or without musical accompaniment) have no doubt a very pretty appearance, but so far as practical effect is concerned, the greater part of what may be called the "variations" might just as well be omitted. The successive facings to the right are absolutely useless, and the successive alterations of the position of the arms very nearly so; the essence of the exercise lying in the "twisting" movement, which developes the *pronator* and *supinator* muscles of the fore-arm. For all practical purposes the same effect would be attained by the repetition of the "twist" the same number of times in one position, say that of Exercise 3, where the extended position of the arms throws a little work, in addition, on the *deltoid* muscle. There is of course *no harm* in the pupil varying the position of the arms as described, but the so doing in exact order involves a needless effort of memory, and further tends to make him imagine that he has done more real work than is actually the case.*

* Such "fancy" movements are quite in place in the gymnasium, where they serve as introductory to, or interludes between, more arduous exercises. The point we desire to enforce is that they are unsuitable for "home" gymnastics, wherein it is important to employ a limited time to the best possible advantage, or in other words to get the *maximum* of practical effect out of each movement made.

Upon the assumption that, as will be the case in most instances, the time available each day for Home Gymnastics is limited, it will be desirable so to arrange the course of exercises that each shall employ not merely a single muscle or group of muscles,* but several, so that the benefit shall be distributed as widely as possible. Such movements may either be made concurrently, or in immediate succession, *i.e.* without bringing back the body in the meantime to its original position.

POSITION.

It is very important that the novice should assume a correct position at starting, as not only the "finish" of his exercises, but much of their effect, will depend upon attention to this particular. He should stand perfectly erect, heels together, feet forming a right angle, head and chin drawn back, shoulders square, chest forward and stomach retracted;† just the

* By a group of muscles, we mean such as co-operate to produce a particular movement. Thus the *biceps flexor cubiti* and *brachialis anticus* co-operate to flex the forearm; and the four muscles conjointly known as the *quadriceps extensor*, to extend the leg at the knee. These may therefore be appropriately described as "groups of muscles."

† There will be found at the outset, particularly in stout persons, a tendency to thrust the stomach forward. This tendency (which, by the way, is increased by the use of unduly heavy dumb-bells)

position, in fact, of a soldier standing at "attention." The arms should hang straight down by the sides, a dumb-bell in each hand, the axis of the dumb-bell horizontal and lying from back to

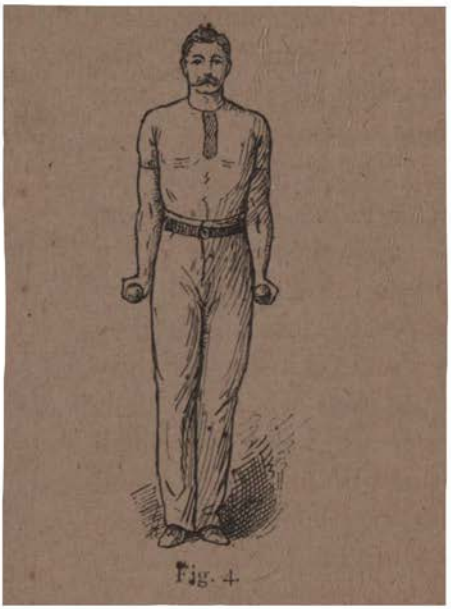

Fig. 4.

front, as shown in Fig. 4. To avoid repetition, this will henceforth be referred to as the position of ATTENTION.

must be stedfastly resisted. Until the correct position is fully acquired, it will be found useful to practise in front of a cheval-glass, so that any deviation may be at once noted and corrected.

EXERCISES.

EXERCISE A.—This being, like many others here described, an exercise consisting of two or three distinct movements, worked in combination, it may be convenient, for the sake of clearness, to describe such movements separately.

Fig. 5.

First Movement.—Starting from Attention, raise the arms, keeping them stiff at the elbow, till they meet above the head. As they rise, they should be turned slightly inwards, so that when the bells meet above the head they shall be in a straight line, end to end (as in Fig. 5). Again lower them to the posture of Attention.

Both movements should be executed slowly and deliberately, the bells not being allowed to fall by their own weight, as they have a natural tendency to do. Much of the value of the exercises here described will be lost, unless the arm *resists* the weight in downward movements, as it of necessity does in upward movements.

This exercise strengthens the *deltoid* muscles

(see p. 41) and renders the shoulders more shapely. The slight twisting movement of the arms also exercises, in some small degree, the muscles which rotate the fore-arm.

We now proceed to the *Second Movement.* Standing at Attention, and keeping the arms motionless at the sides, rise as high as possible on the ball of the foot (Fig. 6), and sink down again, repeating as long as you can comfortably do so. This alternate rising and falling movement necessitates vigorous contraction of the "calf" muscles (*gastrocnemius* and *soleus*, see p. 47). The *extensor* muscles of the toes participate to some extent in the benefit.

Fig. 6.

The two movements above described, as will be seen, each exercise mainly a single group of muscles. In the first the arms are employed, but the legs are idle. In the second, the leg muscles are hard at work, but the arms are idle, and supposing that three minutes were devoted to each exercise, six minutes in all would have been expended. But there is nothing to prevent our working both movements simul-

taneously, when both sets of muscles will have received their quota of exercise, and three minutes of time will have sufficed for both.

The exercise may, however, be made still more effective. Instead of leaving the breath to take care of itself, inhale strongly as you raise the arms, and exhale strongly as you lower them, keeping exact time with the movement.*

* All persons should cultivate the habit of inspiration and expiration *through the nostrils only*, the mouth being kept closed. There are many advantages in this. The process of respiration is rendered more deliberate, and the power of holding the breath is increased. The *fauces* are kept moist instead of getting dry and parched (every wheelman knows the comfort of this in cycling); and lastly, the minute hairs which line the nostril act as a natural "respirator," excluding not only dust, but any bacillic germs which may be floating in the atmosphere, and which if admitted into the system might do injury.

There is a valuable but little-known work by George Catlin, the American traveller, which deals specially with this subject. It bears the quaint title *Shut your Mouth and Save your Life.* (Trübner & Co., London, 4th Edition, 1870.) Mr. Catlin advises as follows:—(p. 86.)

"Keep your mouth shut when you *read*, when you *write*, when you *listen*, when you are in *pain*, when you are *walking*, when you are *running*, when you are *riding*, and by all means when you are *angry*. There is no person but will find, and acknowledge, improvement in health and enjoyment from even a temporary attention to this advice." He goes on further to say, (p. 91)—"If I were to endeavour to bequeath to posterity the most important motto which human language can convey, it should be in three words—

"SHUT—YOUR—MOUTH."

The especial object of the book is to inculcate the closing of the mouth *during sleep*. Mr. Catlin noted that among the North American Indians the mothers always carefully closed the mouths of their sleeping infants. The habit thus formed is maintained

Inhaling and exhaling the breath as above indicated have a very beneficial effect in expand-

through life, and to it Mr. Catlin attributes the singular freedom of the Indian tribes (in their natural state) from decayed teeth, nightmare, diseases of the lungs, and many other disorders that more civilised flesh is heir to. As we have seen, however, his teaching is by no means limited to the hours of sleep; and he adduces sound philosophic reason for his recommendations. He tells us, with ample warrant:

"The mouth of man, as well as that of the brutes, was made for the reception and mastication of food for the stomach, and other purposes; but the nostrils, with their delicate and fibrous linings for purifying and warming the air in its passage, have been mysteriously constructed and designed to stand guard over the lungs—to measure the air and equalise its draughts during the hours of repose.

"The atmosphere is nowhere pure enough for man's breathing until it has passed this mysterious refining process; and therefore the imprudence and danger of admitting it in an unnatural way, in double quantities, upon the lungs, and charged with the surrounding epidemic or contagious infections of the moment.

"The impurities of the air which are arrested by the intricate organisation and mucus in the nose are thrown out again from its interior barriers by the returning breath; and the tingling excitement of the few which pass them cause the muscular involutions of sneezing, by which they are violently and successfully resisted.

"The air which enters the lungs is as different from that which enters the nostrils as distilled water is different from the water in an ordinary cistern or frog-pond. The arresting and purifying process of the nose upon the atmosphere, with its poisonous ingredients, passing through it, is not less distinct, nor less important, than that of the mouth, which stops cherry-stones and fish-bones from entering the stomach. . . .

"Infinitesimal insects also, not visible to the naked eye, are inhabiting every drop of water we drink and every breath of air we breathe, and minute particles of vegetable substances, as well as of poisonous minerals, and even glass and silex, which float imperceptibly in the air, are discovered coating the respiratory organs of man; and the class of birds which catch their food in

ing the chest, and strengthening the muscles (*serratus posticus superior* and *inferior*, the *intercostals*, and the *diaphragm*) which take part in the act of respiration.*

Reverting to our exercise, we may, instead of bringing the dumb-bells up end to end, as shown in Fig. 5, bend the wrists smartly downward and inward as they reach the highest point, so as to bring the bells upright and parallel, as shown in Fig. 7. In commencing the descent, make a sharp outward movement of the wrists in the

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the open mouth as they fly, receive these things in quantities, even in the hollow of their bones, where they are carried and lodged by the currents of air.

"Against the approach of these things to the lungs and the eye, Nature has prepared the guard of the mucous and organic arrangements, calculated to resist their progress. Were it not for the liquid in the eye, arresting, neutralizing, and carrying out the particles of dust communicated through the atmosphere, man would soon become blind; and but for the mucus in his nostrils, absorbing and carrying off the poisonous particles and effluvia for the protection of the lungs and the brain, mental derangement, consumption of the lungs, and death would ensue."

The gymnast may at first find some little difficulty in breathing through the nostrils only. The novice feels as if he could not, in the time available, take in a sufficient supply of air through so narrow a channel; but this feeling will quickly disappear, and the habit, once formed, will be a material assistance towards the acquirement of the still greater desideratum—breathing through the nostrils only *during sleep*.

* So far as we are aware, Professor Dowd alone, among writers on this subject, lays sufficient stress on the extreme importance of the management of the breath in gymnastic exercises. We are indebted to his work, *Physical Culture for Home and School*, for many valuable suggestions in this particular.

opposite direction. This affords good exercise for the muscles of the wrists, the *flexores carpi ulnaris* and *radialis*.

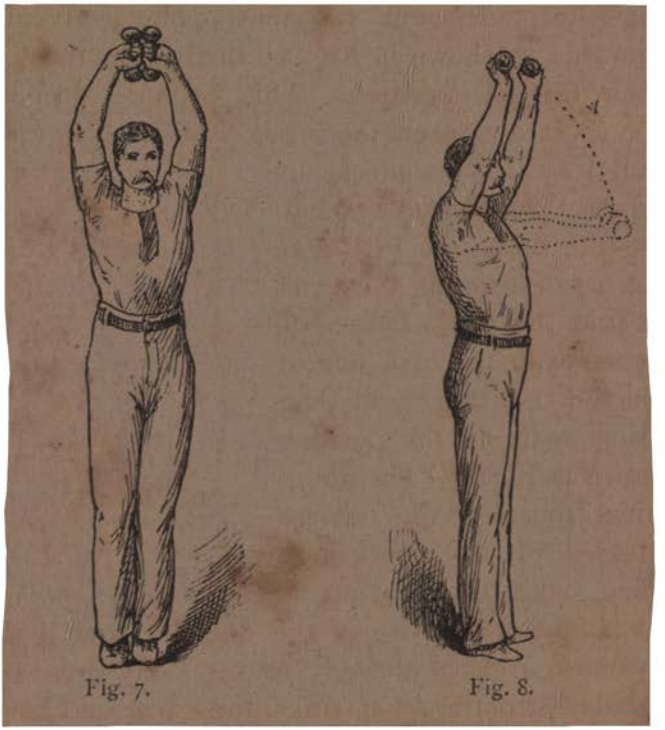

Fig. 7. Fig. 8.

In this combination of movements, which together form Exercise A., we have thus four sets of muscles simultaneously employed, with no greater expenditure of time than would be required for one only. The gain is obvious. Wherever, in the exercises which follow, similar combinations are practicable, we have endeavoured to make them.

EXERCISE B.—Standing as before at "Attention," raise the arms (keeping them rigid at the elbows) straight out in front of the body, continuing the movement till they point vertically upwards, as shown in Fig. 8; then lower them to their original position. This exercise deepens the chest, and strengthens the *deltoid* and *scalenus* muscles. But its effect may be greatly enhanced by bending the body (see Fig. 9) in the act of lowering the arms, so that the dumb-bells shall be made to touch or almost touch the instep; and then rising again to the position shown in Fig. 8. The abdominal muscles, the *erector* muscles of the neck and spine, with the *longissimus dorsi* and *spinalis dorsi*, now take part in the exercise, and if the gymnast inspires strongly as the body rises, and exhales strongly as it sinks, the chest and lungs again share in the benefit.

Fig. 9.

EXERCISE C.—This is a valuable exercise (which may be practised with or without dumb-bells) for strengthening the abdominal muscles. Standing in the latter case with one hand on each hip, (the attitude commonly known as a-kimbo) the

operator bends the body alternately to right and left (as shown by the dotted lines in Fig. 10) as far as possible in the same plane, *i.e.*, not inclining either backwards or forwards. With the dumb-bells the exercise may be made still more effective, as follows :—Hold a bell in each hand, with the arms bent as shown in Fig. 11. As the body inclines to the left, bring the right-hand dumb-bell across the body, and thence in a horizontal circle round the head, finally bringing it back to its former position. (Fig. 12.) As the body bends over to the right, repeat the same

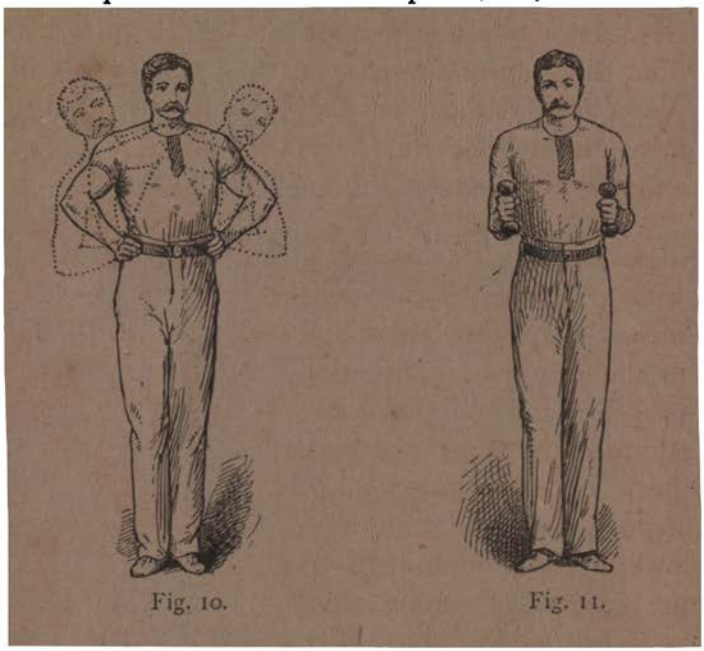

Fig. 10. Fig. 11.

movement with the left-hand dumb-bell. This not only intensifies the work done by the abdominal muscles, but exercises in addition the rotator muscles of the spine and shoulder, and, in a less degree, the *biceps* and *brachialis anticus*.

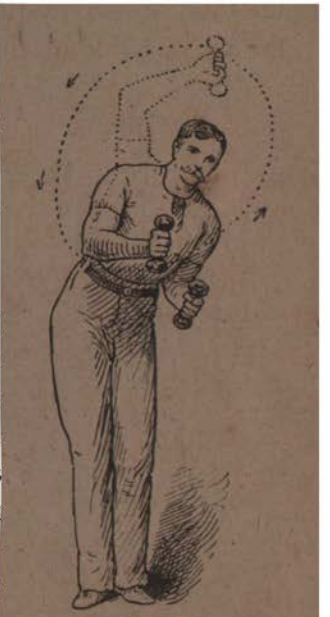

Fig. 12.

EXERCISE D.—Standing with the feet about nine inches apart, but otherwise in the posture of Attention (see p. 60), bend the knees (towards the front) and sink down on the hams as low as possible, at the same time lowering the dumb-bells to the ground on either side, as shown in Fig. 13. Rise up again, straightening the legs, and elevating the body on the toes, as in Exercise A, and at the same time bend the arms, and lift the dumb-bells into the armpits, flexing the wrists so as to get them well home (Fig. 14).

Fig. 13.

These movements, which, in this particular

combination, are the invention of Dr. Herschell,* bring a singularly large number of muscles into action. The bending of the knees employs the *glutei* and the *flexors* of the legs and ankles, while the lowering of the dumb-bells to the floor gives work to the *triceps, anconeus* and *pectoralis.* The rising movement bring into play the *psoas* and *iliacus*, the *quadriceps extensor* (four muscles in one), the *gastrocnemius* and *soleus* (the muscles of the calf), and the *peronei.* The abdominals and the elevators of the spine share to some ex-

Fig. 14.

* Author of *The Health Troubles of City Life* (see p. 2), and a specialist in disorders of the digestive organs. By the courtesy of Dr. Herschell, we are enabled to quote at length the instructions which he is accustomed to place in the hands of patients suffering from insufficiency of exercise. The movements prescribed represent in a small compass a very wide and well-considered selection of muscular exercises, and we can personally testify to their value. The weights indicated are somewhat in excess of those generally approved at the present day, and we think the rule laid down at page 56 will be found, at the outset, a safer guide in this particular. As the strength of the operator increases, the weights may be increased in like manner.

DUMB-BELL EXERCISES FOR THE SEDENTARY. By George Herschell, M.D.Lond. (For the use of his patients.)

In order to keep the body in health, every one must perform a certain amount of muscular work daily. This should be kept apart

tent in the movement (with a host of minor muscles too numerous to mention), while the lifting of the

from, and not confounded with, the fresh air and recreation also necessary. To be of the greatest use, the daily exercise should work most of the important muscles of the body. This is the reason why walking exercise, which only brings into play a certain set of muscles, is not enough for those whose occupations are sedentary. Properly used, dumb-bells can be made to afford this necessary additional exercise. The following movements will be found to be sufficient for the purpose. They should be practised daily on rising in the morning, at first five times each, increasing the number from day to day, always stopping short of absolute fatigue, until they can be performed fifty times each without stopping. When you arrive at this stage, the time has arrived to work with heavier dumb-bells. Always rest for a few seconds between each exercise. Exercises 1, 2, 3, should be performed with dumb-bells of 6—8 lb. for a young man ; 2—4 lb. for a young woman ; and 4—6 lb. for a middle-aged man. Exercises 4 and 5, with 10—15 lb. for a young man ; 4—6 lb. for a young woman ; and 6—10 lb. for an elderly or middle-aged man. All movements to be *slow*, avoiding jerking and swinging.

EXERCISE 1.—Take a dumb-bell in each hand, bend the arms and rest the dumb-bells on the shoulders. Slowly straighten the arms until they are vertical. Lower the bells until they rest on the shoulders again. Continue straightening and bending the arms.

EXERCISE 2.—The arms hanging by the side, nails of hands in front. Raise the dumb-bell slowly to the shoulder, keeping the upper arm fixed close to the body.

EXERCISE 3.—The arms hanging by the side, keeping them stiff and extended, raise them in the plane of the body until they are at right angles to it and in a line with the shoulder. Drop them slowly until they again hang by the side.

EXERCISE 4.—Take the heavier pair of dumb-bells, place one on each side of you on the floor close to the outer side of the feet. Stoop, and grasp them. Gradually straighten the back until you are upright; then bend each arm until you have brought each dumb-bell into the corresponding arm-pit ; keeping them in this position, raise yourself on your toes. Lower yourself gradually, and reverse the movements until the dumb-bells are again on the floor,

dumb-bells into the armpits exercises the *biceps*, *brachialis anticus*, and *flexores carpi*.

In addition to the direct benefit obtained from these movements, there is an incidental advantage in the fact that, from the great bulk of many of the muscles employed, their repeated contraction generates large quantities of carbonic acid. This being thrown into the blood, and thence carried to the lungs, very quickly produces *breathlessness* (which movements of the smaller muscles are much slower to do). The quickened respiration thereby caused is an important factor in producing that elimination of waste material which it is one of the main objects of bodily exercise to promote (see p. 10). Further, the more vigorous expansion of the lungs which breathlessness induces has a marked effect in expanding the walls of the chest, and rendering it more spacious. To favour its operation in this respect, the breath should be inhaled as the body rises, and exhaled as it sinks downward.

EXERCISE 5. "*The Crank.*"—This is especially valuable to those inclined to *embonpoint*. Take the heavy pair, as before, one in each hand, and lower them in the direction of your toes until you have got them as near the floor as you can, bending the body forward from the hips. Now, try and imagine that you are turning the handle of a crank towards you. Keeping the arms stiff and well out away from you, straighten your back as if you were rowing. Now bend your arms and bring the dumb-bells in to your chin, lower them in front of you until they arrive at the first position. Make the motion as circular as you can.

EXERCISE E.—This is another of the special exercises of Dr. Herschell, and like that last described, employs a singularly wide range of muscles.

Fig. 15.

Starting from the position of Attention, bend the body forward at the hips, keeping the arms stiff, and lower the dumb-bells in the direction of the toes, as near the floor as possible (see Fig. 9). Then, rise up again, still keeping the arms extended to the front, but moving the dumb-bells in a circular direction as shown by the dotted arrows in Fig. 15 (as if you were turning the handle of a crank, but in the reverse of the usual direction, *i.e.*, upwards instead of downwards). As the hands approach the chin, square the shoulders and draw back the elbows, keeping them close to the sides, as in running; continue the movement without reverting to the position of Attention.

The forward movement of the body employs

the *psoas, iliacus, pectineus,* and *rectus abdominis.* The rising movement, the *longissimus dorsi* and *erectores spinæ.* The movement of the arms opens the chest and develops the *triceps, biceps,* and *brachialis anticus,* also the middle portion of the *trapezius* muscle.

The breath should, as before, be inhaled as the body rises, and exhaled while it is bending forward.

EXERCISE F.—From the position of Attention, bend the arms at the elbow, so as to bring the bells to the shoulders. Then, extend the arms vigorously, at the same time spreading them to the rear (a little lower than the shoulder), as far back as possible. Finally, again drop them to the position of Attention. The breath should be inhaled during the backward movement.

The first portion of the movement exercises the *biceps* and *brachialis anticus;* the second, the *extensors* of the arms, the *trapezius* and a portion of the *deltoid,* at the same time expanding the chest.

EXERCISE G.—Standing at the position of Attention, raise both arms straight to the front, each bell being held vertically, as shown in Fig. 16. Then, still keeping the arms extended, and without altering the position of the feet, turn the body

to the left as far as you possibly can, then in the same way to the right.

This movement exercises specially the abdominal muscles and the rotatory muscles of the spine, and incidentally the *deltoids* and *extensors* of the arms, *triceps*, *anconeus*, &c.

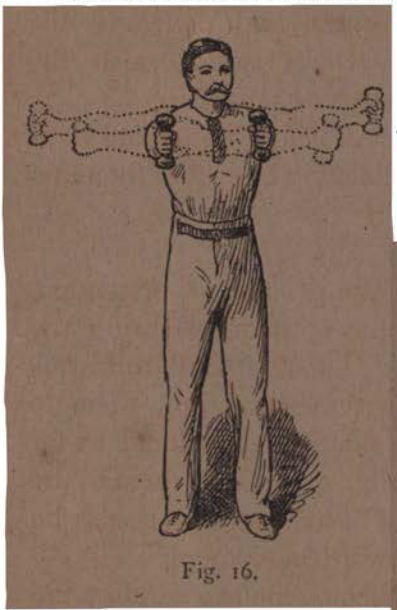

Fig. 16.

Exercise H.—Standing at the position of Attention, make a quarter-turn *of the body only* (without shifting the feet) to the left, and at the same time elevate the bells vertically above the head, as shown in Fig. 17. Then, make a like quarter-turn to the right, meanwhile lowering the arms in front

Fig. 17.

of the body, and bringing them up to the same position on the opposite side, as shown by the dotted lines.*

Fig. 18.

This movement exercises very much the same muscles as the last, with the addition of the *serratus magnus*, and the rotator muscles of the shoulder.

EXERCISE I.—Standing at the position of Attention, turn the hands so that the finger-nails shall be to the rear, and move them slightly forward as to clear the body. Then, keeping the arms fairly stiff, let the dumb-bells cross each other, and continue their movement in an upward direction (as shown by the dotted lines

* This is one of the introductory "Indian-club" exercises, but it is equally effective with the dumb-bells. That next following (Exercise I), is also a "club" exercise.

It may be regarded as an omission by some readers that Indian-club exercises, as such, are not included in the present work, but it has been thought better on the whole to exclude them. This little book is intended for the million, and the exercises described in it are purposely limited to such as demand no special dexterity

in Fig. 18) till they have each described a complete circle, again crossing each other at the top. Continue the movement till you have completed half your intended number of revolutions, and then return to the starting position. After a moment's pause, lift the arms from the sides, and rotate them in front of the body in the opposite direction, the hands crossing in the first instance at top.

These movements tend to develop the *pectorales* and the rotator muscles of the shoulder.

EXERCISE J.—This movement, for which we are indebted to a German work,* has some resemblance to that last described, but gives employment to a

or previous practice for their due performance. The management of the Indian-clubs, on the other hand, is an *accomplishment*, only to be attained, in any complete degree, by long practice under skilled personal instruction. A very good manual on the subject, by Professor E. F. Lemaire, is published by Messrs. Iliffe & Son, but the number of exercises described, and the complicated appearance of the diagrams which illustrate them, are enough to frighten any but a thorough gymnast.

The clubs, moreover, share with fencing, and indeed with all difficult exercises, a disadvantage in a hygienic point of view, in the sustained *attention* which they demand, involving a constant strain, more or less, upon the mental faculties. It may be taken as an axiom, that the more mental labour a given exercise involves, the less valuable will it be as a means of improving health. It is true, that even the most difficult exercise may be practised until it becomes to a considerable extent *automatic;* but in the meantime its effect on the system is exhausting, rather than recuperative.

* *Haus-Gymnastik für Gesunde und Kranke*, by E. Angerstein and C. Eckler, Berlin, 1890.

far wider range of muscles, and is worthy of special attention. Standing with the feet apart, at a distance of about twenty inches from heel to heel, the gymnast describes with each bell a circle in a vertical plane immediately in front of the

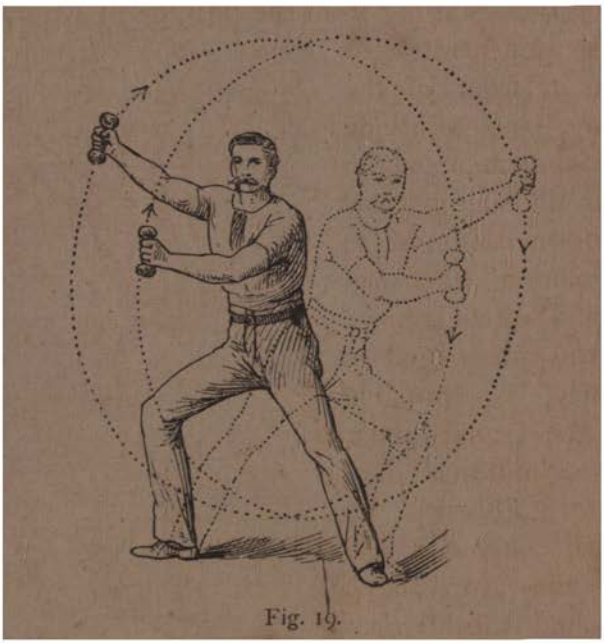

Fig. 19.

body, but in this case both in the same direction. As the bells tend to the one or the other side, the knee on that side is flexed, and that on the other side stiffened (see Fig. 19). The muscles brought into play by this movement are almost too numerous to specify. The *pectorales*, the abdominal muscles,

those of the neck and spine, the pelvic muscles, and those of the leg and thigh, are all brought into rapid and vigorous contraction.

EXERCISE K.—This is another very valuable exercise. Starting from the position of Attention, raise the arms straight out in front of the body, and continue the movement to the rear, till each bell has performed a complete revolution. Each arm should be kept straight at the elbow, and as nearly as possible in the same plane throughout the movement. This will be found easy enough till the arms have reached the vertical position. At this point they are *bound* to diverge, or the revolution could not otherwise be completed, but they should be allowed to do so as little as possible (see Fig. 20). The breath should be taken as the arms ascend. This exercise broadens and deepens the chest, and

Fig. 20.

at the same time strengthens the *pectorales* and the rotator muscles of the shoulder.*

Inhale as the arms rise; exhale as they fall.

EXERCISE L.—This movement is the same as that last described, save that the arms are rotated in the opposite direction, *i.e.*, from below upwards. It is good exercise for the *pectorales* and the shoulder muscles, but is a degree less valuable than Exercise K, inasmuch as it does little or nothing to expand the chest.

EXERCISE M.—Stand with the heels about six inches apart, the arms held straight up above the head. Bend the knees, keeping them as wide apart as possible,† so that the body shall sink down to within ten or twelve inches of the floor (the lower the better), and at the same time flex the arms, drawing the elbows down to the sides,

* It is a curious thing, that rotatory movements, which form almost the whole of the Indian-club exercises, are scarcely ever used in connection with dumb-bell work, though they may be employed therein with the greatest possible advantage. Even Professor Dowd, who shows full appreciation of the value of rotatory movements in connection with the pulley-weight apparatus, does not give one such movement for use with the dumb-bells.

† It should be noted that there is a distinct difference between the leg movement here and in Exercise D (see p. 69). In the latter case the flexure of the knees is towards the *front*, in this case it is as nearly as possible in the same plane, like the movement of a pair of lazy-tongs.

and the dumb bells close to the shoulders (see Fig. 21). Then rise again to an erect position, at the same time extending the arms above the head as before. This movement exercises the *deltoids*, the *triceps* and *biceps* of the arms, and the *flexors* and *extensors* of the leg and thigh, including the *sartorius* muscle, which ordinarily gets but little work to do. Some little practice will be needed to perform it neatly, a novice having usually a tendency to lose his balance in rising, but the effort to maintain it is very beneficial in strengthening the abdominal muscles. It is well to practise in the first instance the leg movement *alone*, with the hands resting on the hips; and when this can be executed with facility, to add the arm movement.

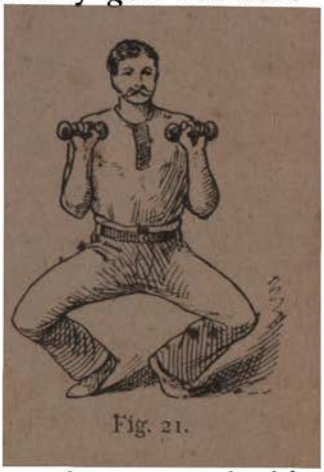

Fig. 21.

EXERCISE N.—We have up to this point done comparatively little for the flexors and extensors of the arms. These are best developed by a few comparatively simple movements, which we proceed to describe.

Extend the arms horizontally from the shoulders to either side, as shown in Fig. 22.

Bend the wrist alternately up and down as far as possible, as shown by the dotted lines. This looks easy work, but it is surprising how soon the novice will have had enough of it, and even the practised gymnast does not care to keep it up

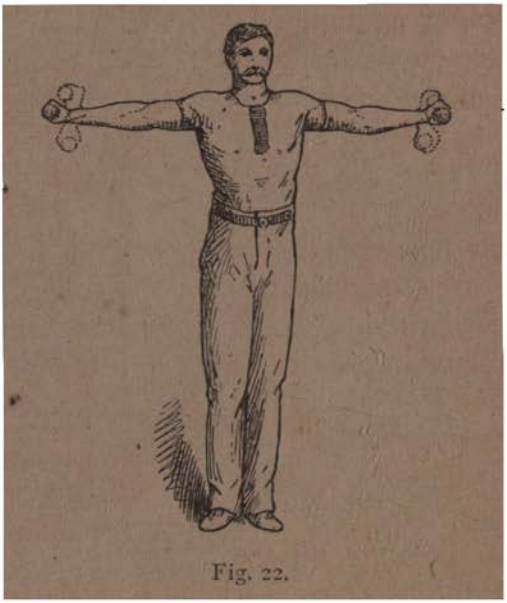

Fig. 22.

very long. The up and down movement of the wrist makes very active work for the muscles of the fore-arm, (particularly the *palmaris longus* and *flexores carpi*), while the effort of holding the arms extended in one position causes a considerable strain upon the *triceps* and *deltoids;* for it must be remembered that a muscle which is occupied in merely resisting force may be just as hard at

work as if it were in actual movement. Indeed, the effort of passive resistance very often involves the greater strain. In the present case, what the arm is called upon to support is not the weight of the dumb-bell only, but such weight multiplied by the leverage of the arm, which magnifies it in a surprising ratio.

Fig. 23.

EXERCISE O.—Extend the arms horizontally, but in this case straight out to the front, with the backs of the hands upwards, as shown in Fig. 23. Bend the wrists outward till the finger-nails are brought uppermost, then in the contrary direction till the backs of the hands as nearly as possible face each other. Repeat as long as strength permits.

The muscles more especially affected by this exercise are the *pronator quadratus* and *supinator longus*. Incidentally, as in the last case, the *deltoid* muscles and the extensors of the arm also share in the work to a considerable degree. If the strain on these latter be found too great, the arms may be drawn back till the

elbows touch the sides as in Fig. 11 and the exercise continued in that position, but it will be found impossible to make so near an approach to a complete revolution as in the former case.

EXERCISE P.—Standing at the position of Attention, raise the arms in the plane of the body

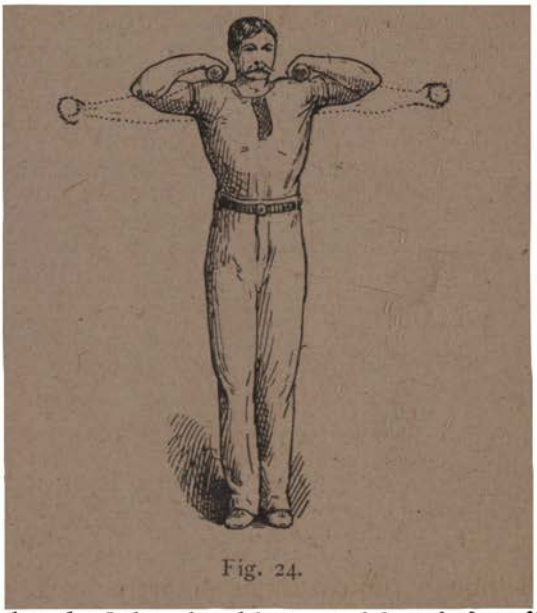

Fig. 24.

to the level of the shoulders, and bend the elbows so as to bring the bells down upon the collar-bone, as shown in Fig. 24. Again extend the arms, lower them to the sides, and repeat *ad lib.* The work is here thrown mainly on the *biceps* and

brachialis anticus, though the *deltoid* shares in it to some extent.

EXERCISE Q.—Starting from the position of Attention, bend the arms so as to bring the dumb-bells to the shoulders, as in Fig. 25; extend them vigorously to right and left as shown by the

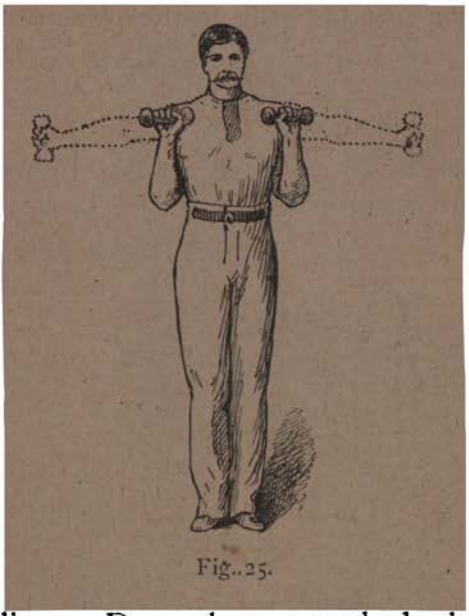

Fig. 25.

dotted lines. Draw them smartly back to the shoulder, and let the arms again fall to the position of Attention.

After having executed this movement, say twenty times, vary it by shooting the arms perpendicularly *upwards*, instead of *outwards* from

the shoulder. After another twenty movements again vary by shooting the arms out horizontally to the front, again drawing back to the shoulder and falling back to Attention as before.

All three movements exercise very much the same sets of muscles, viz. the flexors and extensors of the arms, the *trapezius*, and the *deltoids*, as well as deepening and expanding the chest. In the case of the two latter muscles, however, each variation sets in motion to some extent a new set of fibres, and the exercise is less fatiguing to the arm muscles than if the same movement were repeated without alteration.

Fig. 26.

EXERCISE R.—Standing with the heels eighteen to twenty inches apart, elbows to sides, and bells drawn back to the shoulder, strike out with the right and left arm alternately in a direction a little above the level of the shoulder. As you extend the *right* arm, stiffen the *left* leg, and *slightly* flex the opposite leg as shown in Fig. 26. When you extend the left arm, the left leg will be flexed and the right leg stiffened.

The striking movement will develop the extensor muscles of the arms, rendering them not only stronger, but more flexible and rapid in action; while the straightening of the opposite leg in unison with the blow will do the same for the extensors of the leg, and less directly, for the abdominal muscles.

EXERCISE S.—Standing in the posture of Attention, the arms holding the dumb-bells hanging down stiffly by the sides, draw up the shoulders strongly (as in the movement known as "shrugging" the shoulders) and then force them down as strongly, as though some counter-force was pressing the dumb-bells upwards. You will find that this alternate movement very speedily produces a sharp ache between and across the shoulders, a sure proof that it is throwing unaccustomed work upon some muscle or muscles in that quarter. As a matter of fact, the "lifting" movement exercises the middle portion of the *trapezius* muscle, and the downward movement the *pectoralis minor* and the *latissimus dorsi*, the broad muscle behind and below each shoulder.

In this case, the movement being of very brief duration, it is well to inhale with the upward movement, then to hold the breath, with the chest fully expanded, as long as can be done with comfort, meanwhile repeating the alternate move-

ment, and finally to exhale with the downward movement. Take a full breath with the next upward movement, and proceed as before.

Fig. 27.

EXERCISE T.—Starting at the position of Attention, make a half-turn to the left.* Bring up the left arm till the dumb-bell rests on the hip, and the right arm till the dumb-bell is level with the shoulder. This is the position for the movement. From this position step forward about twenty inches with the right foot, bending the right and stiffening the left knee, and at the same time thrust the dumb-bell in the right hand vigorously forward and upward, at an angle of 45° to the body, as in Fig. 27. Return to position, and repeat as may be desired; the foot should be brought forward smartly, and with a slight stamp, like the lunge of a fencer, and

* The neatest method of doing this is to draw back the left foot till its hollow rests against the heel of the right, and then, lifting the toes, to turn smartly on the heels. At the finish of the movement, the right foot should be pointing straight to the front, and the left foot at right angles to it, *i.e.*, straight to the left.

recovered in like manner; the left hand remains throughout on hip.

EXERCISE U.—Make a half-turn to the right, and go through the same exercise with the *left* arm and foot, the dumb-bell in the *right* hand resting on the hip.*

The muscles exercised by these two movements are very numerous, comprising the deltoid, the flexors and extensors of the arms and legs, the erectors of the spine, and the abdominal muscles; in fact, very nearly the same muscles as are used in the fencing school, with the important modification that both sides of the body receive an equal share of exercise, which is not the case in fencing.

* When these two exercises are performed *en masse* in the gymnasium, they are usually worked alternately, returning after each "charge" to the position of Attention; but the above method is preferable for home use.

CHAPTER VII.

THE PULLEY-WEIGHT APPARATUS.

We now pass to the consideration of an apparatus of a different kind. The work done in this case consists of pulling or thrusting at a stirrup-handle attached to a cord, such cord being normally drawn by the downward pull of a weight in the opposite direction. The cord passes over a pulley or pulleys, so arranged that the direction of the "pull" can be varied at pleasure. Appliances of this kind, under the names of "chest machines," "rowing machines," &c., have been in use for many years, but have for the most part been too cumbrous and too expensive for general adoption. Of late, however, the ingenuity of experts has been directed to their improvement, and at the present day such contrivances can be procured in much more convenient forms, and at a fraction of their former cost. We have selected for illustration two, either of which can be recommended as sufficiently answering its purpose.

The first, Fig. 28, which may be taken as the prototype of the new departure, is the invention of an American, Professor D. L. Dowd, Director

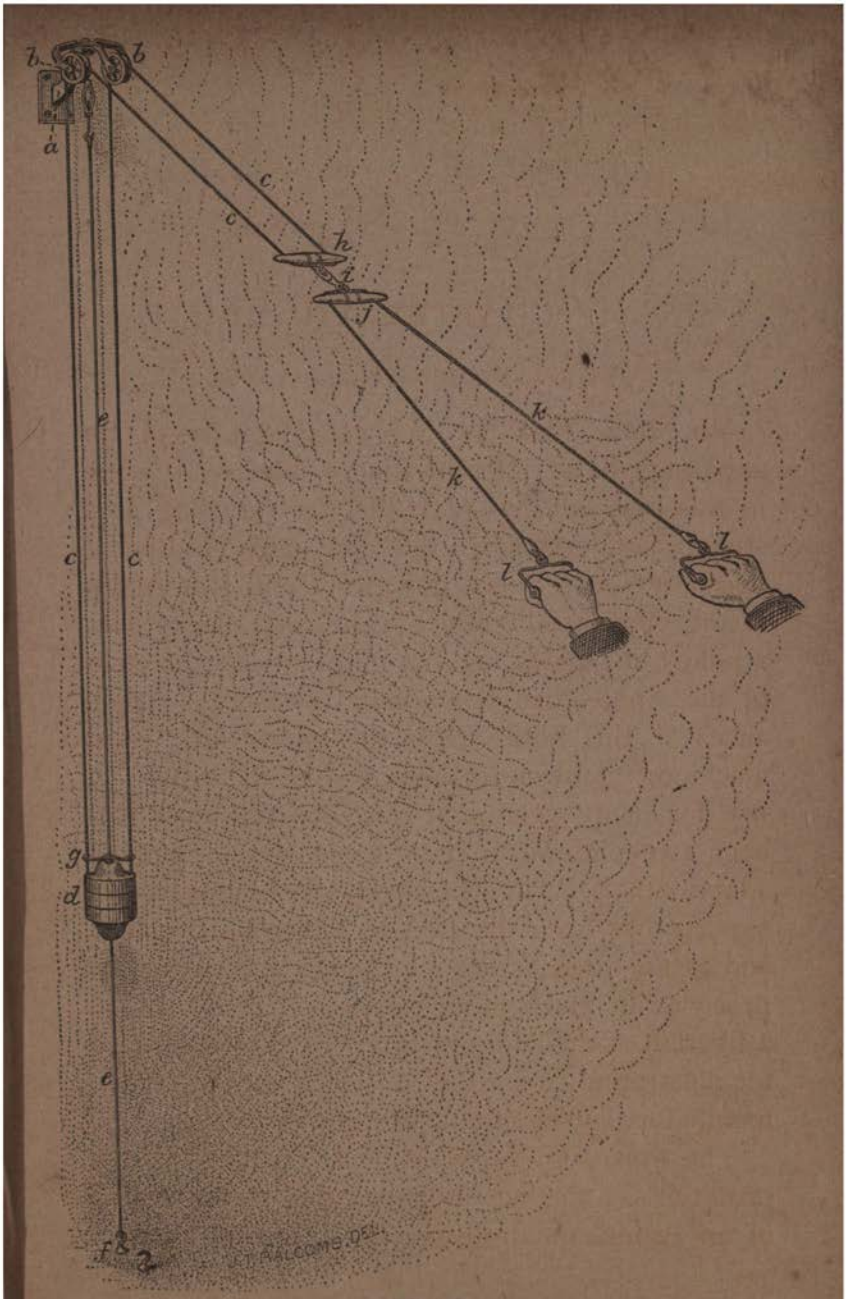

Fig. 23.

of the School for Physical Culture, East Fourteenth Street, New York.*

The machine is known indifferently as the "Home Exerciser," or "Health Exerciser," and is constructed as follows :—

a is a bracket, firmly screwed to the wall at a height of seven feet six inches from the floor. This has a movable arm bearing a couple of pulleys, *b b*, over which pass two cords, *c c*, in connection with a weight, or rather group of weights, *d*. (The shape of the single weight is shown at *x* in Fig. 29.) The undermost weight alone is actually attached to the cords, others being superimposed upon this till the desired amount of resistance is obtained. A stretched wire, *e e*, extending from the bracket *a* to a screw-hook, *f*, in the floor, passes through the centre of each weight, keeping them steady, and preventing their swaying from side to side.† The bent wire,

* The agent for Europe is Mr. R. H. Greenleaves, who conducts a similar school at Windsor Villas, Prestbury Road, Macclesfield. Of Mr. Greenleaves can also be obtained (price 6*s.* 6*d.*) Professor Dowd's treatise, *Physical Culture for Home and School*, a work which contains much valuable matter in relation to physical development. The exercises given in this book are the most complete we have seen, and we are indebted to it for many valuable suggestions.

† The lifting of the weight by two cords is a faulty arrangement, as the least inequality of tension pulls it *askew*, in which condition it tends to "bind" on the guide-wire. A single lifting cord is decidedly preferable.

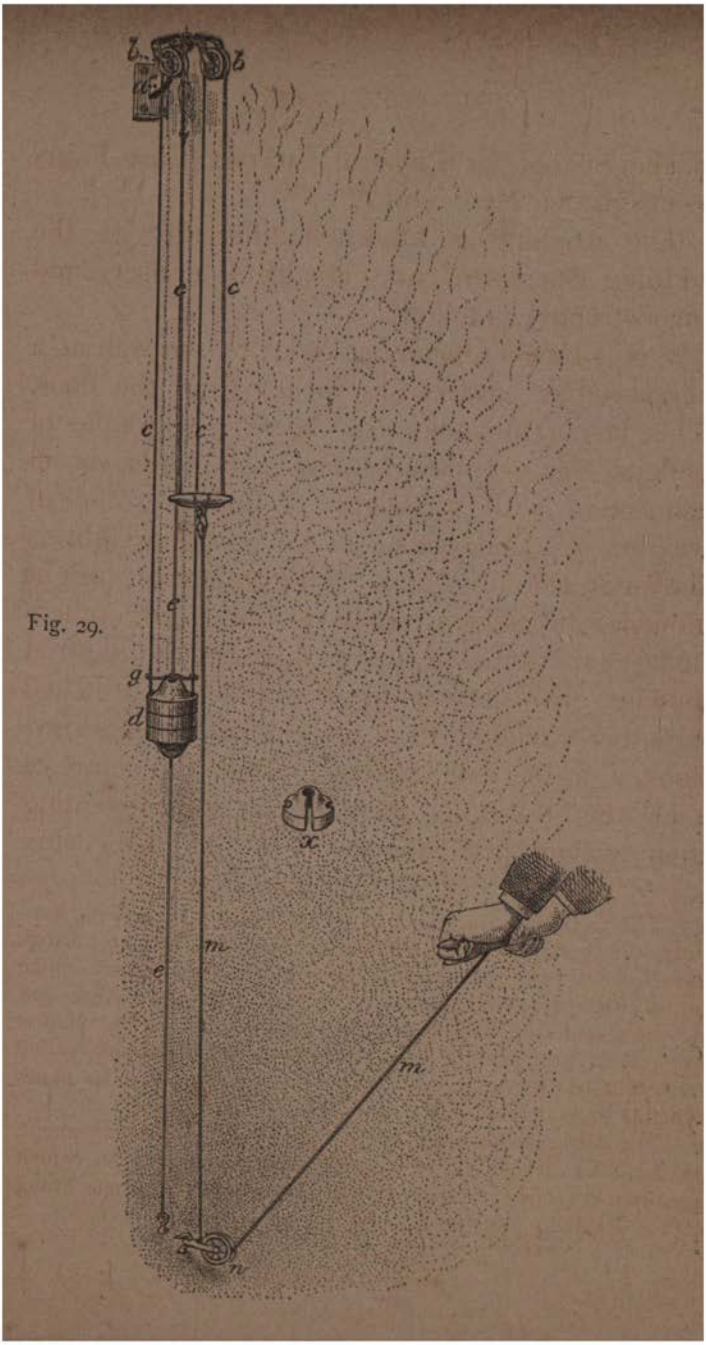

Fig. 29.

g, helps to maintain them in position. The upper ends of the cords *c c* are attached to a yoke, *h*, and this, by means of a swivel joint, *i*, at its centre, to a second yoke, *j*. From the extremities of this depend two other cords, *k k*, each terminating in a stirrup-shaped handle, *l*.

When an upward, instead of a downward, pull is desired, the cords *kk* and the yoke *j* are removed, and a single cord, *m*, of greater length, with a cross handle, is passed through the pulley *n* (which is screwed into the floor, about eight inches in front of *f*), and attached to the centre of *h* in their place. (See Fig. 29.)

Fig. 30 represents another form of Home Exerciser, the invention of Mr. A. Alexander, the director of the Liverpool Gymnasium. The pulley and guide-rods are in this case affixed to an upright back-board five inches in width and six feet in length. This is secured to the wall in any convenient position. The group of weights, *a*, is in this case supported by a movable bracket, *c*, working up and down between the guide-rods, *dd*. It is drawn up by a single cord, *bb*, and rests, when not in use, on a cork buffer, *c*. The weights, which are of two pounds each, take the form shown in Fig. 30 B, the opening at the back enabling them to be passed sleeve-fashion over the square upright rod, *e*, which is fixed to the back of the movable

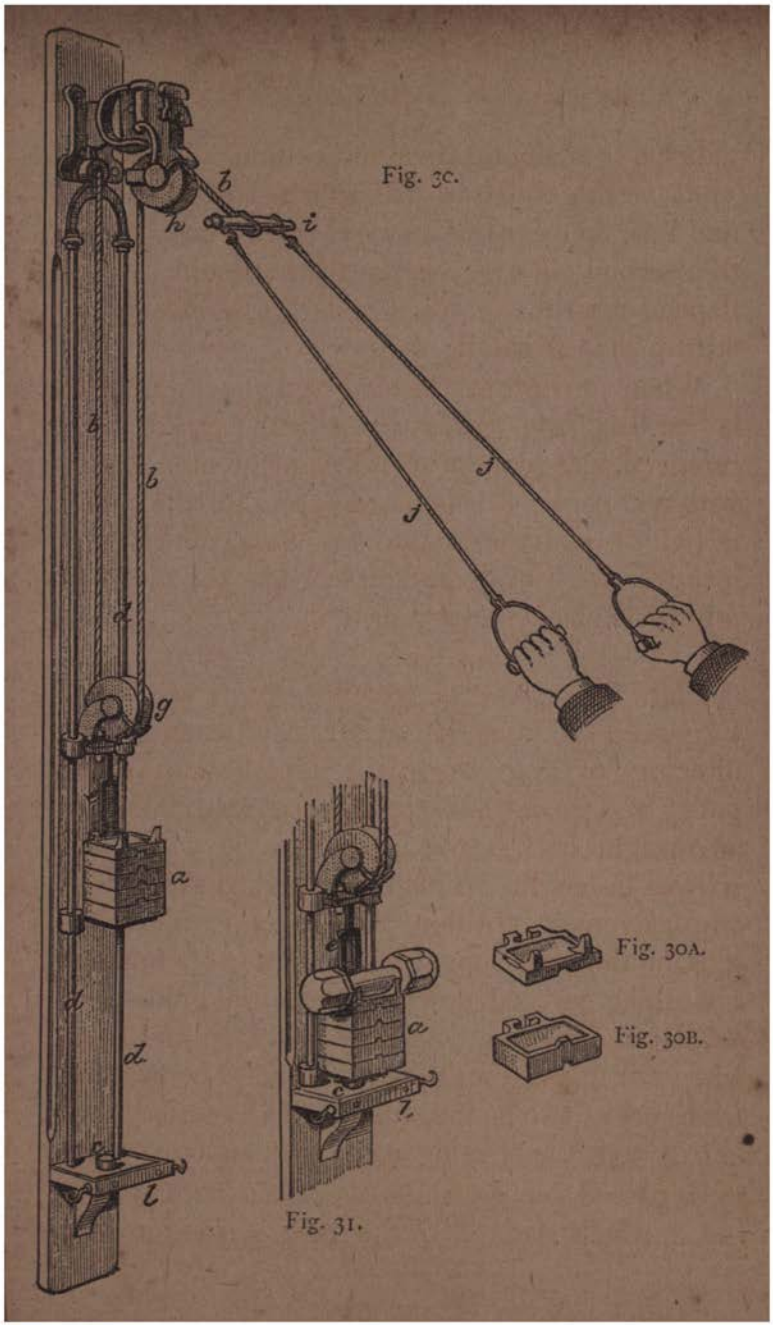

Fig. 30.

Fig. 31.

Fig. 30A.

Fig. 30B.

bracket. This arrangement holds them securely in position, the use of the single pull and double guide being a decided improvement on the opposite arrangement. Of the weights any number, up to seven or eight, may be used. The uppermost is of one pound only, but has a couple of upright pins, as shown in Fig. 30 A, projecting from its upper side, so that a dumb-bell may be laid across it as shown in Fig. 31; thus affording a means of further increasing the weight to any desired extent. It will be observed that the cord *bb*, starting from the upper bracket, passes round a movable pulley, *g*, before it reaches the fixed pulley *h*. The addition of the movable pulley seems at first sight an improvement, inasmuch as the weights, which in Dowd's Exerciser rise and fall some four feet, here travel only half that distance, enabling the height of the apparatus to be considerably reduced. This makes it more compact and portable, but at some sacrifice of effectiveness, for there is a distinct advantage for certain movements in having the downward pull approaching the *vertical*, and this it cannot be unless the fixed pulley is seven feet six inches from the floor. If so fixed as to bring the upper pulley to this height, the lower extremity of the board would be eighteen inches from the ground, at which height the *upward* pull, (of which we shall presently speak) would be comparatively useless. If fixed, on the other

hand, low enough to make the upward pull effective, the upper pulley would be only about six feet from the floor, which in the case of many exercises would bring the *downward* pull too low for effective use. In the writer's own practice with the Alexander machine, he has met this difficulty by fixing the machine at the higher altitude, and to the floor immediately below it, a block of wood (six inches in length by four in width, and two inches thick), into the ends of which are screwed a couple of supplementary hooks to receive the pulleys for the upward pull. A nearly vertical pull is thus obtained in either direction.

It should, however, be stated that with the exception of the rowing movement (see p. 128) almost every exercise for which the *upward* pull is designed may be performed just as effectively with the dumb-bells. There is a certain convenience in being able to work the whole series of exercises with the same machine, but it is quite a matter of taste whether this or the "bells" are used for the exercises in question.

The use of the movable pulley, in accordance with a well-known mechanical principle, halves the resistance of the weight, so that to get a "pull" of 10 lbs., you must, roughly speaking, put 20 lbs. on the machine.*

The free end of the cord *bb* is attached to the

* The calculation is not exact, because the bracket which supports the movable weights itself weighs about 2 lbs., thereby adding 1 lb.

centre of a yoke *c*, to the ends of which are affixed two other cords, terminating in stirrup handles, as in the apparatus already described.

Where it is desired to get an upward instead of a downward pull, the two last-mentioned cords are disconnected from the yoke *i*, and two longer cords, first passed through the pulleys *kk*, are attached to it in their place. (See Fig. 32.) *

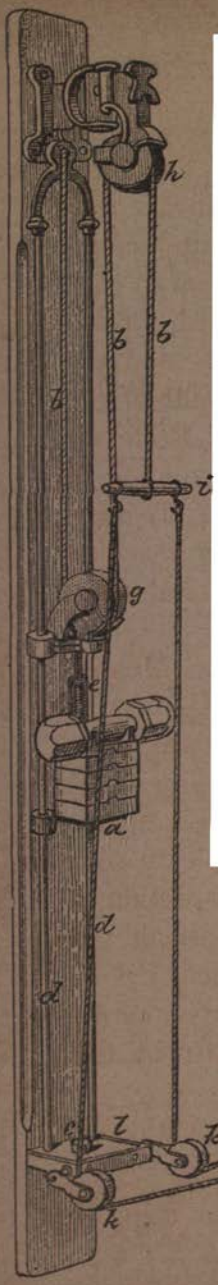

Fig. 32.

to the pull, and the friction to be overcome may be reckoned at another half pound. In practice, 17 lbs. of movable weights require a pull of about 10 lbs. to lift them.

* These pulleys are attached by two hooks to the wooden bracket *l*. This, as the Exerciser is at present made, is a faulty arrangement, for the yoke *i* in descending is apt to strike the ascending weights. This could be cured, for rowing machine purposes, by making *l* project a little more, so as to give better clearance. In all upward pulls, however, the pull should start from the level of the feet, as already indicated. The use of two cords instead of one for the upward pulls is a decided improvement on the single cord of Professor Dowd.

In point of cost there is little to choose between the two machines. Mr. Alexander's apparatus sells at 40*s.*, and Professor Dowd's, in a corresponding grade of finish, at 42*s.* The latter makes also higher priced Exercisers ranging up to 74*s.*, but the only difference lies in extra finish (bronzing or nickel-plating of metal portions, and the like), adding nothing to the practical value of the instrument. It should be noted that Professor Dowd includes in the price above quoted, a copy of his book, *Physical Culture*, already mentioned,* a very useful addition. Either machine may be had without the upward pull, at a reduction of ten shillings.

Mr. Alexander's London agents are Messrs. Geo. Philip & Son, 32 Fleet Street, E.C.

There is a third form of Exerciser which we may incidentally mention, known as an *Accumulator*, and procurable, in various degrees of strength, of any dealer in gymnastic apparatus. Its construction will be understood from an inspection of Fig. 33. *a* is a ring wherewith to attach the apparatus to a hook fixed at a convenient height in the wall; *bb* and *cc*, *cc* are stout hempen cords, and *dd* cords of india-rubber, kept apart by the cross bar *e*; *ff* are the handles.

This apparatus being fixed as above mentioned,

* See p. 92.

the user standing with face or back towards it, and grasping the handles, is enabled to go

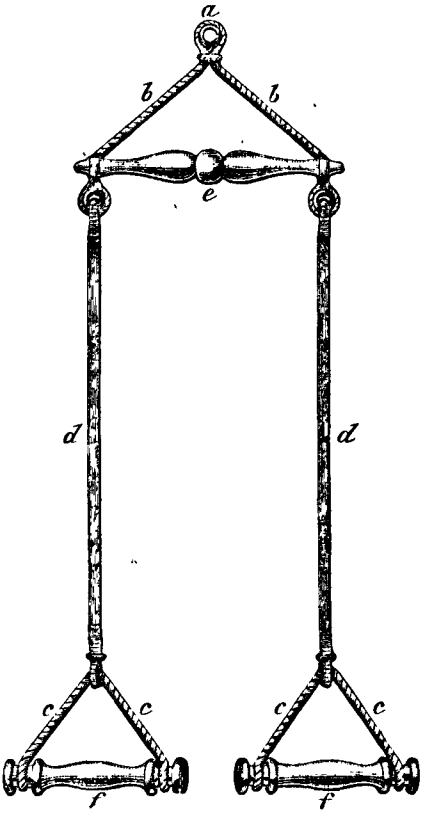

Fig. 33.

through many of the exercises appropriate to the pulley-weight machine.

It has been urged as a defect in the Accumulator that its resistance is not uniform, being *nil* at

the beginning of the pull, and becoming needlessly strong towards its close. Some, on the other hand, put this forward as a recommendation, asserting that muscle is developed to the best advantage by overcoming this sort of "give and take" resistance.* There is a more serious drawback in the possibility that the rubber, particularly if it has been left unused for any length of time, may snap at the moment of the greatest strain upon it, but a little caution should suffice to avoid any risk in this particular. Reverting to the pulley-weight apparatus, the first point to be considered is the amount of weight to be used, and here, as in the case of the dumb-bells, there is considerable conflict of opinion. The weights recommended by Mr. Alexander are 3lbs. for trunk and 6lbs. for arm work.† These, in view of the fact that both hands are employed, and divide the weight between them, seem to us inadequate. Professor Dowd, on the other hand, recommends a weight of five to ten lbs. to begin with, to be gradually increased (as improved strength may

* An argument in favour of this view may be found in the undoubted fact that professional "strong men" frequently, as part of their training, exercise with a piece of thick rubber cord. No handles are used, but the rubber is merely held one end in each hand, and stretched in various directions. The power of the grip is said to be enormously increased by this exercise.

† We take this to refer to the actual *pull*, the weights on the machine being so arranged (see p. 97, as to be equivalent to that amount.

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warrant) to fifteen, or in the case of very strong men, twenty lbs. It is proverbially difficult to "decide where doctors disagree," and still more so to lay down a canon which shall suit all cases, but it is easy to devise a workable rule of proportion. The plan we advocate is to begin with a pull of half a pound for each stone of personal weight, to be gradually increased as strength permits to one lb. per stone, which for health purposes should be the outside limit. It is far better to err on the side of lightness than excessive weight, and if it be found that the weight in use is more than can be manipulated with ease—that there is a tendency to get the body pulled out of a perfectly erect position, or to bend the waist too far forward or backward in the effort to maintain such a position—the pull should at once be reduced to a more comfortable limit. It cannot be too strongly impressed upon the home gymnast that the development of muscle, and still more the quickened respiration and quickened circulation on which the value of exercise, as a health-giver, so much depends, are more rapidly and effectively produced by quick movements overcoming slight resistance, than by slow movements overcoming greater resistance. In other words, it is the number of times a muscle contracts, and not the force with which it contracts, that most contributes to its perfect development.

CHAPTER VIII.

EXERCISES WITH THE PULLEY-WEIGHT APPARATUS.

It will have been observed that the construction of the pulley-weight apparatus admits of the force of the pull being exerted in two opposite directions: 1, downward; 2, upward. This renders it available for a wide variety of exercises, which may be further diversified in effect by altering the position in which the operator stands. This may be either with face, with back, or right or left side to the apparatus, each such alteration of position bringing, more or less, a different set of muscles into operation.

It is desirable frequently to vary the position as above, as the so doing distributes the labour done, resting the muscles which have been in action, and calling upon others which have not hitherto been used.

A correct position at starting is here quite as essential as in the case of the dumb-bell exercises. (See p. 59) The elements of the position are practically the same as in that case, viz., head thrown back, shoulders squared, chest forward, stomach retracted. But there is in this

case a difference, arising from the fact that the operator is here, in most of the exercises, drawn by the force of the pulley-weight *towards the apparatus*, whereas the weight of the dumb-bells operates necessarily *downward*. To counteract this pull towards the machine, it is generally advisable, before beginning the specific exercise, to take a pace forward or backward, as the case may be, with the one or the other foot, thereby enlarging the performer's base, and enabling him the better to resist the force of the pull.

If the operator is facing the machine, he will naturally step *backward*, the weight being thrown on the hinder foot. If standing with his back towards it, he should take a step forward, and throw the weight on the forward foot, the opposite limb being stiffened so as to offer the most effectual resistance to the force pulling in the opposite direction.

The distance of the operator from the machine should be so regulated that the weight shall, when the hands are *nearest*, be lifted a few inches from its position of rest. The tension of the pull will then be continuous throughout the exercise.

Our opening exercises are primarily designed to promote the development of the chest.*

* Any absolute division into "chest" exercises, "arm" exercises, &c., would be impracticable, for, with the exception of a few of the very simplest movements, there is scarcely an exercise

EXERCISE AA. (*With downward pull.*)

Stand with face to the machine, one handle in each hand, arms extended horizontally in front, palms facing each other. Take a short pace backward with the right foot, and let the weight

Fig. 34.

of the body rest upon such foot, at the same time bracing the left leg so as to resist the forward pull of the weight. Head and shoulders back, chest forward, stomach retracted. (See Fig. 34.)

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that could be devised which employs *exclusively* a particular set of muscles. Our own endeavour, in the series here given, has been to indicate exercises which will employ simultaneously the largest possible number of muscles.

Having got the position correctly, move the arms slowly backward in a horizontal direction, each describing a quarter of a circle, till they reach the position shown by the dotted lines in the figure. Simultaneously with the principal movement, turn each hand over inward, so that, when the movement is finished, the *back* of the hand shall be to the front. When the arms have gone back to their fullest extent, let them slowly return to their original position, maintaining throughout a steady resistance to the opposing pull of the weight.*

So much for the movement itself, but, here as with the dumb-bell work, its value as a hygienic exercise may be greatly enhanced by the judicious management of the breath. The operator should inhale (through the nostrils)† as the arms are drawn back, and exhale as they return to their first position. The inhalation through the nostrils may upon first trial seem difficult, the

* The twisting movement is an addition to the primary exercise. Such an addition is optional, but wherever it is practicable to work two distinct movements in combination, there is an obvious gain in doing so. Professor Dowd gives no less than thirty-four exercises for the pulley-weight apparatus. All are good in their way, but by judicious combination the series might have been made very much shorter without detriment to its practical utility. In this high-pressure age, the amount of time which most persons can devote to hygienic exercise is limited, and it is therefore essential to employ such time to the greatest possible advantage.

† See p. 63.

novice usually feeling as if he could not get sufficient breath in this manner, but a little practice will make it easy.

The muscles here employed are, in the backward movement, the *trapezius*, *rhomboideus major* and *minor* (the muscles which draw the shoulder-blades together), and a portion of the *deltoid*. The twisting movement exercises the *biceps* and the pronators and supinators of the fore-arm, and the forward movement the *pectorales*. The rise and fall of the chest in the act of inspiration and expiration exercise the diaphragm and intercostal muscles. Meanwhile the whole exercise affords good work for the extensors of the arms, which are continuously employed throughout the operation.*

* It must be borne in mind (see p. 82) that a muscle may be doing very hard work without being in actual movement. To convince himself of this, let the reader take a light dumb-bell (say two pounds only), and try how long he can hold it horizontally at arm's length. The exertion seems nothing, but after the lapse of a minute or two he will find that the weight appears to grow heavier and heavier, and a little later the arm will drop to the side from sheer exhaustion.

The work done by the muscle in the above and similar cases is known as *passive resistance*, and the primary duty of many of our muscles is to do just this kind of work. Take, for instance, the muscles known as the *erectores spinæ* (see p. 45). If we bend the body forward, it is their function to bring it back to the upright position, but their habitual work is simply to keep it erect. Such muscles are therefore exercised as well by passive as by active use. The man who holds himself habitually upright, with head erect and shoulders square, is unconsciously exercising the muscles

EXERCISE BB.—Turn the back to the apparatus and take a handle in each hand, extending the arms horizontally on either side, as shown in

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which tend to keep him in that position, and as a consequence, they will always be found in good condition, and performing their work automatically. He, on the other hand, who makes a practice of sitting or standing with bent head and rounded shoulders, allows these muscles to become, by disuse, weak and inert, and can only assume the erect position by a distinct and painful effort of the will.

Allied to this, but yet differing from it, is the work thrown on a muscle by what is called *latent stimulation*. This term is given to the condition of a muscle in a state of what may be called anticipatory tension, as that of the cat crouching for a spring, the runner preparing to "go" in a race, or the fencer feeling with his blade the blade of his adversary, and ready to lunge the instant an opening is given. A similar condition arises in boxing, wrestling, &c. The subsequent fatigue is in such cases far more than proportionate to the amount of muscular exertion undergone; the reason being that they involve, in the words of Lagrange, "a continuous nervous expenditure, an incessant stimulation emanating from the grey matter of the brain. While the fencer on the watch has all the appearance of complete repose, his brain and nerves are in a condition of excessive tension. Like a Leyden jar being charged, his muscles are making, in a manner, a store of nervous energy, in order that at the right moment the will may suddenly determine the explosion of movement." For this reason, Dr. Lagrange condemns fencing as an exercise for men who study much, or for young persons who do much brain-work. On the other hand, for persons of active brain, but little mental occupation, or for those of corpulent habit, he as strongly recommends it. "Fencing," he tells us, "like all exercises which produce disturbances in the nervous system, is a most valuable exercise to persons who wish to get thinner. Among the most important functions of the nervous system is that of regulating nutrition; so we see all fatigue borne by the nerves, all excessive expenditure of nerve force lead to diminished energy of the process of nutrition, and favour the opposite process, thereby causing loss of weight."

Fig. 35. Let the arms go back as far as possible, so as to draw the shoulder-blades together. Then bring the arms forward to the position shown by the dotted lines, the cords passing over the shoulders, one on each side of the head.

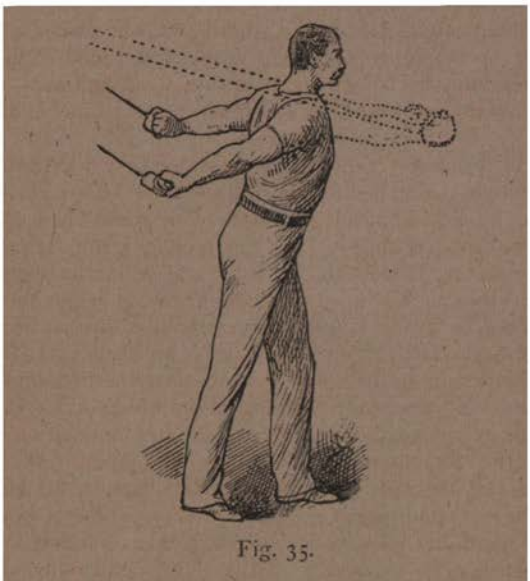

Fig. 35.

Take a deep breath as the arms go back, and exhale as you bring them together again. Repeat *ad libitum.*

This it will be seen is the converse or complement of Exercise AA. The main movement is the same, but the effect is different. In the former case the pull of the machine tended to draw the arms forward, so that the hard work of the exercise fell upon the *trapezius* and the *rhomboideus major*

and *minor* (the muscles which draw the shoulder-blades together), and so move the arms apart. In this case the force of the weight works in concert with the above-mentioned muscles, and the brunt of the exercise falls on the *pectorales*, which draw the arms together.

This exercise is primarily one for the benefit of the chest and chest muscles, but it may also be made to afford good work for the muscles of the forearm. To effect this, when the arms have reached their utmost point of expansion, bend the wrists backward as far as they will go, and, on the return, check the movement of the arms so soon as they are parallel with each other, and continue it with the wrists only, bending them forcibly inward. This movement sets the flexors of the wrist in vigorous action, and, if frequently repeated, will be found most effective, not merely in strengthening, but in improving the shape of the forearm, the full development of these muscles contributing in a marked degree to the grace of its outline.

EXERCISE CC. (*With downward pull.*)

Stand with *back* to the machine, and arms extended to the front (about the level of the waist), and take a step forward with the left foot, as shown in Fig. 36. The force of the weight is now pulling you backward, and you must therefore

throw the chest well forward, and brace the right leg, in order to neutralise it.

Keeping the arms as stiff as possible, let each, *moving in the direction shown by the dotted* lines, describe a complete circle, returning to their original position. Inhale strongly as the arms ascend, and exhale as they descend. After having done this ten or a dozen times, hold the breath, with the chest fully expanded, and repeat the movement as many times as you can without inconvenience, but still adhering to the rule that when you do exhale, it shall be with the descending, and when you inhale, it shall be with the ascending movement.

Fig. 36.

This exercise is extremely valuable, partly for the work it gives to the *deltoid*, *trapezius*, and *pectorales*, but more especially for the energy with which it expands the walls of the chest, and for the vigour it gives to the respiratory muscles. In conjunction with the two or three exercises which

next follow, it will be found to enlarge the chest to an extraordinary degree, a gain of two or more inches in circumference being by no means unusual. As to the value of such an increase, apart from the obvious improvement of figure thereby produced, we need only refer to an often quoted passage in Dr. Morgan's "*University Oars.*" "An addition of three inches to the circumference of the chest implies that the lungs, instead of containing 250 cubic inches of air as they did before their functional activity was exalted, are now capable of receiving 300 cubic inches within their cells. The value of this augmented lung accommodation will readily be admitted. Suppose, for example, that a man is attacked by inflammation of the lungs, by pleurisy, or some one of the various forms of consumption, it may readily be conceived that, in such an emergency, the possession of enough lung tissue to admit forty or fifty additional cubic inches of air will amply suffice to turn the scale on the side of recovery. It assists a patient successfully to tide over the critical stage of his disease."

EXERCISE DD. (*With downward pull.*)

Standing with the arms uplifted in front as shown "dotted" in Fig. 36, and holding them stiff as before, again describe a circle with each, but in the opposite direction, *i.e.*, falling as the arms pass in

front of the body, and rising as it travels behind it. The muscles employed are much the same as in the exercise last described, but they are employed in a different manner, and fibres previously passive come into active operation.*

The breath should be inhaled as the arms begin to rise behind the body, and exhaled when they have reached their highest point, as shown by the dotted lines.

EXERCISE EE. (*With downward pull.*)

Detach the cords and handles, and standing close to and facing the apparatus, grasp the yoke, one end in each hand, the arms being extended to full length above the head. Draw the yoke slowly down to the full extent of the arms, and repeat the raising and lowering motion alternately, inhaling as the arms rise, exhaling as they sink again. Throughout keep the head up, the shoulders square, and the chest forward. A slow motion is better than a quick one.† After breathing some eight or ten times as above, taking care

* It may be taken as an axiom, that wherever it is possible to work the same movement in two opposite directions, it is always desirable to do so.

† It will be seen that this movement is practically the same as that of *bell-ringing*, which has a particularly beneficial operation in expanding the chest. The movement is also identical in effect with the familiar "pull up" to the horizontal bar, for which it is a very good preparation, pretty nearly the same muscles being employed, and in the same way, save that in the case of the bar they have to lift a mass many times heavier, viz., the weight of the body.

Where this exercise is used not merely for health purposes, but

always to fill the lungs to their utmost capacity, the breath may be held, as in Exercise CC., while the movement is four, five, or more times repeated.

The muscles here chiefly employed are the deltoid, the flexors and extensors of the arms, the *trapezius*, the *latissimus dorsi*, and the respiratory muscles.

The same exercise may, by a little modification, be rendered yet more effective, as follows:—When, in executing the downward pull as above described, the hands have reached their lowest point, continue the downward motion with the body, sinking down upon the hams till the knuckles touch the floor between the feet, then rise again to the erect position. This additional movement exercises the "hamstring" muscles, and the *gastrocnemius* and *soleus*, the muscles of the calf, besides throwing some useful work on the extensors of the toes. In again raising the body, the *quadriceps extensor femoris* is brought into action. Further, from the large bulk of the muscles employed, a proportionately large quantity of carbonic acid is thrown into the blood, thus producing the "breathlessness" which, as we have seen, has so large a share in the beneficial results of exercise.

as a preparation for regular gymnasium work, there is no objection to gradually increasing the weight, as strength permits, considerably beyond the ordinary limit, say to 50 or 60 lbs. It will still be much below the weight of the body, as pulled up to the horizontal bar.

This exercise practically illustrates what we have said (p. 96) as to the desirability of the overhead pull starting from a height of not less than 7 ft. 6 inches.

If this be found too severe a task (as it probably will by many persons), a compromise may be made by simply rising on the toes as the yoke descends, and sinking down again as it ascends. The hamstring muscles now take no part in the work, but those of the calf are kept in active and beneficial operation.

EXERCISE FF. (*With downward pull.*)

Having replaced the cords and handles (removed for the purpose of the last exercise), stand with the back to the apparatus, the arms extended (palms downwards) straight to the front, with a handle in each hand. Keep the arms stiff, the hands about eight inches apart. Step forward with the left foot, and throw the weight of the body upon it, at the same time bracing the hinder leg, so as to resist the rearward pull. Now, keeping the arms stiff and the chest forward, let the arms travel upwards till they reach a vertical position, inhaling as you do so. Then bring them down again to their original position, at the same time slowly exhaling. Do this a few times, and then alter the breathing arrangement, making one inspiration serve for half a dozen or more upward and downward movements.

This is a partial combination of CC and DD, and may be used as an alternative exercise by those persons who may find CC and DD too fatiguing.

The upward movement exercises the *deltoid* and *trapezius*, and the downward the pectoral muscles, while both employ the extensors of the arms and the respiratory muscles.

The foregoing exercises, regularly practised, will do all that is needful for the development of the chest. Those next following are mainly designed for the improvement of the arm and leg muscles, though, as will be seen, the benefit to be derived from them is by no means limited to those members.

EXERCISE HH. (*With downward pull.*)

We will begin with an exercise for the *striking* muscles. These are primarily the *triceps* and *anconeus*, but the act of delivering a vigorous blow is a complex one, employing more or less a very large number of muscles.

Standing with back to the apparatus, right foot advanced, and chest thrown forward, take both handles in the right hand, resting the opposite hand on the hip. Draw the arm slowly back to the shoulder (see Fig. 37), and then thrust it vigorously out again, as shown by the dotted lines, at the same time throwing the right shoulder forward, and stiffening the left side and leg. Let both blow and return be as straight from and to the shoulder as possible.

Here, in the forward thrust, we find employed,

in the arm itself, the *deltoid*, *triceps* and *anconeus*, but many other muscles work in concert with them. The *pectorales*, *serratus magnus*, and *obliquus abdominis* help to throw the shoulder forward, and the extensors of the left leg, by stiffening the limb, further enhance the force of the blow. By *resisting* the pull of the weight in the return movement (drawing back the arm), the same muscles receive further exercise, and the benefit is maintained throughout.

Fig. 37.

Having sufficiently tired the right arm, repeat with the left in like manner. The left arm, in most persons, is a little weaker than the right. This is a defect, arising simply from the fact that the left arm is habitually less used. The home gymnast should not rest content until, by dint of exercise, he has brought the weaker limb up to the same standard as its stronger brother.

EXERCISE II. (*With downward pull.*)

But we may do more yet to develop the *triceps*. The mechanism of the human frame is

contrived with such exceeding art, that a given muscle frequently performs a double function,* and to give it full employment, not *one*, but many, exercises are necessary.

Stand facing the apparatus, with a handle in each hand. Extend the arms, palms upwards, horizontally in front of the body, as shown in Fig. 38. From this position lower the arms, still keeping them extended, till they are as shown by the dotted lines. As they descend, turn the palms inward, continuing the rotatory motion so that when the arms reach the position indicated, the hands shall be *back to back*. Then let them slowly revert to

Fig. 38.

* In the well-known words of Pope :—

"In works of man, though laboured on with pain,
A thousand movements scarce one purpose gain.
In God's, one single can its end produce,
Yet serves to second too some other use."

Any one who has occasion to study the mechanism of so-called automata, even the most admirable of their kind, will be enabled to appreciate the unapproachable perfection of the human organism, and the comparative clumsiness of the most elaborate mundane contrivances.

their original position. Inhale as the arms ascend, and exhale as they descend.

This exercise tends to develop the *triceps* (especially that portion which is nearest the body), the *pectorales, latissimus dorsi,* and the *pronator* and *supinator* muscles of the fore-arm. The *biceps* also is benefited by the twisting movement.

Fig. 39.

EXERCISE JJ. (*With upward pull.*)

Remove the cords of the downward pull, and substitute those for the upward pull. Taking a handle in each hand, stand facing the apparatus, and close to it, so that the force of the pull shall be as nearly vertical as possible. Keeping the arms straight, "shrug" the shoulders, lifting them as high as possible. Then depress them, with a distinct downward thrust, as low as possible. (See Fig. 39.)

The upward movement helps to develop the *trapezius, rhomboidei* and *levatores scapulæ,* and, in a less degree, the *pectorales.* The muscles chiefly affected by the downward movement are the *latissimus dorsi* and *obliquus abdominis,* but all the muscles of chest and back largely participate. No one who

has not actually tried it would believe the amount of real work there is in this apparently trifling movement.

An economy of time may be effected by working this simultaneously with the exercise next following.

EXERCISE KK. (*With upward pull.*)

Standing in the position last above described, a handle in each hand, and the arms hanging down by the sides, rise on the toes as high as you possibly can, and then *slowly* sink down again; the weight of the body being supported on the ball of the foot. Continue as long as strength will permit.

This movement, small though it is, throws very severe work on the *gastrocnemius* and *soleus*, which together make up the calf of the leg. To improve the shape of a too scanty calf, this exercise will be found invaluable.

Where these two exercises are worked in conjunction, the body should rise simultaneously with the lifting of the shoulders, and sink down as they fall.

EXERCISE LL. (*With upward pull.*)

Stand facing the machine, arms extended to the front, palms upwards. Take a short pace back with the right foot, throwing the weight upon such foot, and stiffening the left leg.

Now bend the arms, bringing the handles as close to the shoulder as possible, then extend them straight downwards and outwards on either side, carrying them as far to the rear as you can.

Again extend the arms to the front, and repeat until the muscles are fairly tired.

A full, deep inspiration should be taken at starting, and the breath held as long as can be done with comfort. When needful, exhale, and take another deep inspiration, so that the chest shall be kept fully expanded.

The muscles here employed are primarily the flexors and extensors of the arms. The upper arm gets the larger share of the work, which is mainly done by the *biceps*, *brachialis anticus*, *triceps*, and *trapezius;* but the *pectoralis major* and *latissimus dorsi* participate to a greater or less extent. The respiratory muscles also share, but this happens in the case of all vigorous movements.

EXERCISE MM. (*With upward pull.*)

Facing the machine, and taking a handle in each hand, sink down gradually on the ball of each foot, as shown in Fig. 21, then slowly rise again to the upright position, taking care throughout to keep the shoulders well back, chest forward, and head upright. As you rise, bend the elbows and wrists so as to bring the handles under the

armpits. This, which is one of the movements specially recommended by Dr. Herschell, is primarily an exercise for the flexors and extensors of the legs, giving employment not only to the *gluteus maximus*, and the *quadriceps* and *biceps* of the thigh, but also, by the work thrown on the ankle, to the *tibialis anticus*, a muscle in front of the leg, which took no part in the work done in KK. Its benefits, however, do not end here, for the rising movement more or less involves the abdominal muscles, the *longissimus dorsi*, and the elevators of the spine. For these latter, however, we shall find more direct work in the next exercise. The bringing of the hands into the armpit gives employment to the *biceps*, and the flexors of the wrists.

EXERCISE NN. (*With upward pull.*)

Standing with face towards machine, feet together side by side, stoop down, keeping the body rigid save where flexed at the thigh, and take a handle in each hand. The distance should be so regulated that there shall even in this position be a distinct tension on the cords. (See Fig. 40.) Keeping the arms stiff, rise to the erect position as shown by the dotted lines, and bend backward so as to hollow the back as much as possible, at the same time throwing the chest forward and head back. The knees must be kept stiff throughout.

The stress of this exercise, though it employs many muscles more or less, falls mainly on the *trapezius*, *erectores spinæ*, and hamstring muscles; all the muscles, in fact, which tend to keep the body erect. For this reason it will be found

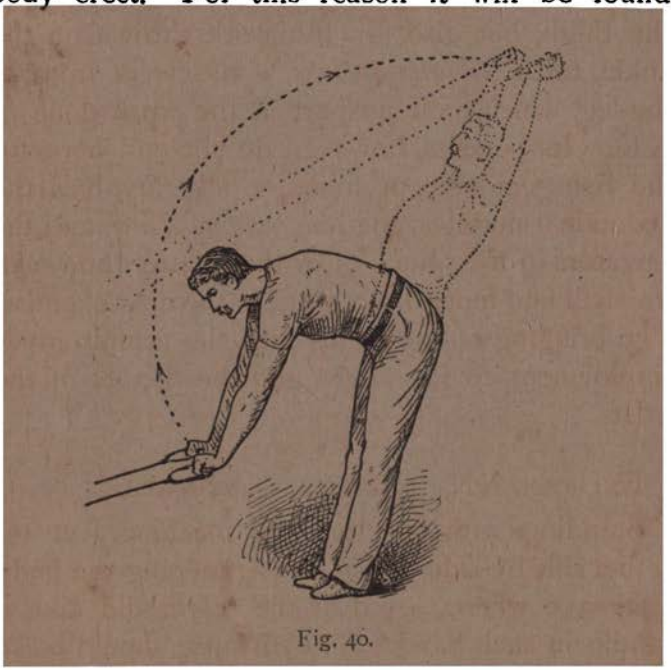

Fig. 40.

extremely beneficial to any person of a stooping habit. It also strengthens the abdominal muscles, and relieves them of superincumbent fat, which fact gives it special value in the treatment of obesity. Exercise MM. will also be found very effective for the latter purpose.

EXERCISE OO. (*With upward pull.*)

Face the machine at some little distance, a handle in each hand, the arms extended to the front, palms upwards, as shown in Fig. 41. Bend the arms, drawing the handles as nearly as possible into the armpits (see dotted lines).

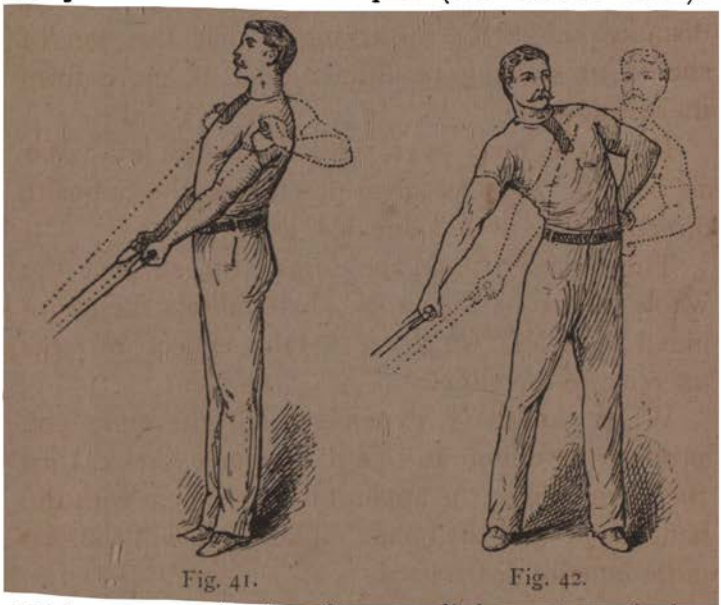

Fig. 41. Fig. 42.

This necessarily involves a slight twist of the fore-arm, and the combined movement has an extraordinary effect in the development of the *biceps*, which has a double function, viz., to flex and to rotate the fore-arm. The movement described calls upon it to perform both duties simultaneously; hence its special effectiveness as a gymnastic exercise.

EXERCISE PP. (*With upward pull.*)

Stand with right side to the pulley-weight apparatus; right hand holding *both* handles, arm extended, sloping downwards at about 45° from shoulder. Feet eighteen to twenty inches apart. Left hand resting on hip. (See Fig. 42.) The distance should be so arranged that the weight should at starting be lifted a foot or more from its resting-place.

Bend the body over sideways to the left as far as possible, then as far as possible in the opposite direction (see dotted lines).

The knees should be kept stiff, so that the whole brunt of the work shall fall on the abdominal muscles, which it is the object of this exercise to develop.

When you have expended half the time you propose to devote to this particular exercise, turn the other side to the apparatus, and repeat with the handles in the left hand. The work will thus be more equally distributed.

EXERCISE QQ. (*With downward pull.*)*

Replace the cords appropriate to the downward pull. Stand sideways to the machine, with both handles in the right hand, as directed for the last exercise, the weight being lifted a foot or so,

* This exercise can be performed with either the downward or the upward pull, but the former is preferable.

and stretch the arm to its full extent. (See Fig. 43.) Then, keeping it stiff at the elbow, draw it gradually down (as shown by the dotted lines), as far as you can *in front of the body*. Let it slowly rise again to its former position, then once more draw it down, but this time *behind* the body. Repeat this alternate movement until the muscles are thoroughly tired.

Fig. 43.

Any one ignorant of anatomy would probably imagine that you were exercising throughout the same muscles, but such is by no means the case. The muscle which draws the arm in front of the body is the major pectoral, as you can readily prove by placing the disengaged hand on the chest, in front of the armpit. When the arm is brought forward, this muscle swells and hardens under the hand, but when the arm is passed behind the body, it remains flaccid, showing that it now takes no part in the action. On the contrary, if you place the hand on that portion of the back immediately behind the armpit, you will

find that the muscle there situate (the upper part of the *latissimus dorsi*) is in contraction when the arm is drawn behind the body, but quiescent when it is passed in front of the body.

EXERCISE RR. (*With downward pull.*)

Standing with face to the machine, feet

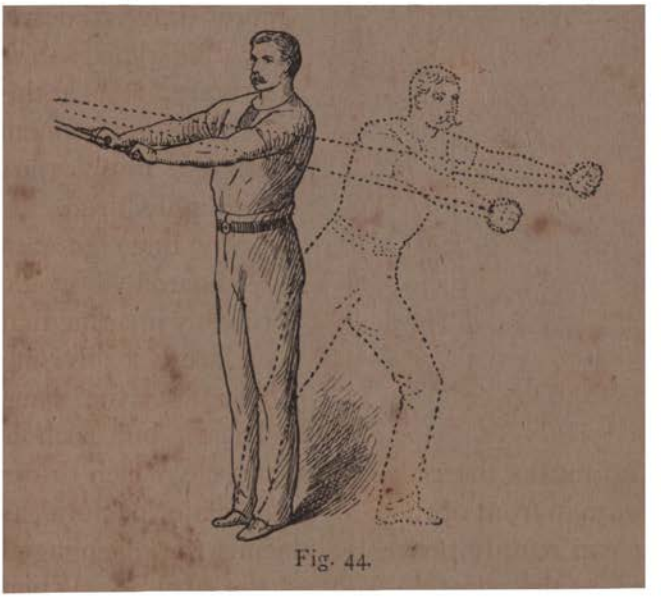

Fig. 44.

together, arms horizontally to the front, and weight slightly lifted—step back as far as you comfortably can with the left foot (the right remaining unmoved), and at the same time make a slight turn to the left, and draw both handles past the body on that side. (See Fig. 44.) Return

smartly to the first position ; then move the right foot to the rear, and draw the handles past the body on *that* side. Repeat the alternate movement, as above.

A very large number of muscles take part in this exercise—those principally concerned being the flexors and extensors of the arms and legs, the *pectorales*, *latissimus dorsi*, and abdominal muscles.

EXERCISE SS. (*With downward pull.*)

Stand with the back to the machine, feet together, arms extended vertically above head. Step forward about twenty inches with the right foot, and at the same time lunge vigorously forward with both hands in the same direction. Recover your original position, then step forward in like manner with the left foot, and thrust the handles in *that* direction.

The muscles employed are here very much the same as in the last exercise, but the mode of their employment is different, and the one exercise forms just the needful complement of the other.

EXERCISE TT. (Rowing Exercise.) *With upward pull.*

For the purpose of this exercise, where used, two additional items will be necessary, a low hassock, five or six inches in height, and a foot-

board, secured to the floor just in front of the base of the machine, and having a couple of straps for the feet. The hassock being placed on the floor at a convenient distance from the instrument, the operator seats himself upon it, places his feet within the straps, and with the knees

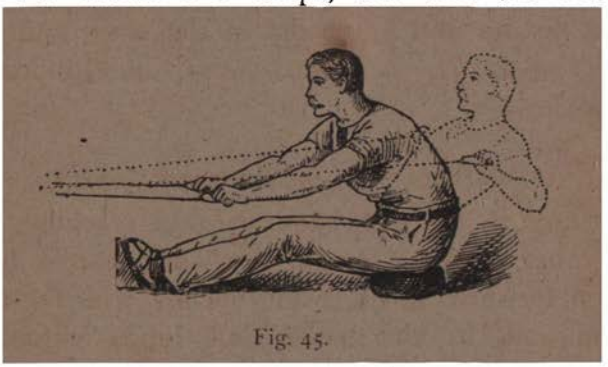

Fig. 45.

slightly bent, grasps a handle in each hand. (See Fig. 45.) The length of the cord must be so regulated that to do this he must bend forward over the toes, with the arms extended, the weight being lifted, by the tension of the cords, about six inches from its position of rest.

This done, the operator draws back his body and arms to the position shown by the dotted lines, the legs being straightened, the hands drawn well in to the chest, and the body inclined backwards till it forms an angle of about 40° with the floor. He should then return to his original position, with the hands as far over the toes as

possible, simulating as nearly as he can the movements of a rower in an outrigged boat.

This movement employs the flexors, the lumbar muscles, the extensors of the legs and extensors of the arms, and the erector muscles of the spine. The respiratory and abdominal muscles also participate in the exercise.

If the operator uses this exercise as a means of keeping himself in training for actual rowing work, he should as the arms come back to the chest, drop the wrists, and bend the hands backward, thereby simulating the movement of "feathering." This position of the hands should be maintained until the arms have again reached their full stretch over the toes. This addition will be found to contribute greatly to the strengthening of the wrist and the development of the forearm.

The fixed foot-board with straps is in itself, even without the pulley-weight apparatus, a valuable adjunct to Home Gymnastics. The operator, seating himself in this case on the floor, should place his feet in the straps, and cross his arms over the chest. He should then alternately allow his body to sink backwards at full length, and rise again to the sitting position without using the hands, but by the mere strength of the lumbar muscles, the legs being meanwhile kept

down by the securing of the feet in the straps. Special care should be taken that the body should not swerve from side to side, but move steadily through the same plane, both in ascending and descending.

This will be found a considerably more laborious exercise than the foregoing, wherein the operator is aided in the return movement by the pull of the weight. The arms here take no part and the legs but little in the movement; it exercises the lumbar and abdominal muscles in a way in which they are rarely or never called upon in ordinary life, and the benefit to health and strength is proportional. The exercise in question is one of the best possible as a remedy for dyspepsia, and is also exceptionally valuable in the treatment of obesity.

CHAPTER IX.

EXERCISES WITHOUT APPARATUS.

We have already recorded our conviction that exercise, to produce its maximum effect in a hygienic sense, should have some mechanical resistance to overcome.* Hence the value of appliances like the dumb-bells or the pulley-weights, which furnish such resistance in an easily graduated and constant quantity. But there are some few exercises of such a nature that they do not need or gain little from the use of such appliances, by reason that the weight of the body, or of a given member, itself furnishes a sufficient resistance. Thus in walking, running, and leaping, exercise may be carried even to the point of exhaustion without the use of any external appliance. These are familiar instances, but there are other cases less obvious to which the same principle applies, and for the sake of completeness it will be well to indicate them.

First and foremost come exercises for the muscles of the neck. These muscles are liable to

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* See page 53.

various forms of weakness, which render them less able to perform their special duty of keeping the head erect, poised easily and gracefully upon the shoulders. As a consequence the neck becomes scraggy and ill-formed, with probably a couple of ugly depressions before and behind the collar-bone. It may be welcome news to persons so afflicted to know that such defects can be cured by means within the reach of every one, if only they have the courage and patience to persevere long enough in the treatment. The actual period required for the cure will vary according to the longer or shorter standing of the defect to be rectified.

EXERCISE 1.—Stand with feet together, head thrown back, chest forward, hands on hips. Now let the head drop as far as it will go towards the right shoulder, then in like manner towards the left shoulder. Continue the motion alternately from side to side, as nearly in the same plane as possible, *i.e.*, not allowing the head to tilt either more forward or more backward than its original position. This exercise develops and strengthens the *sterno-mastoid* muscles (see p. 41), situate one on either side the neck.*

* Professor Dowd recommends the employment of the pulley-weight apparatus for these exercises, the hand holding the handle close to the side, front or back as the case may be of the head, so

EXERCISE 2.—Standing in the same position, let the head drop forward on the chest as far as possible, then draw it back till the face is almost parallel with the ceiling. Repeat until the neck is thoroughly tired.

The forward movement exercises the *platysma myoides*, a broad thin muscle which covers the front of the neck. The backward movement is equally beneficial to the upper portion of the *trapezius*, which covers in like manner the back of the neck.

These are muscles which in an ordinary way get very little exercise, and suffer accordingly. Any one who will persevere in these two exercises for, say, three months, will note a marked improvement in the contour of the neck, and if the carriage of the head has been previously defective, a similar improvement will be found in this direction.

EXERCISE 3.—The hanging forward of the

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that the muscle shall, when the head moves in the opposite direction, have to overcome the resistance of the weight. We cannot endorse this recommendation. In the first place, the use of the pulley-weight apparatus as directed is awkward and troublesome; and secondly, it is calling upon the muscles in question to do work beyond their proper function. The muscles of the arm are intended by nature to overcome amounts of resistance far in excess of the weight of the limb itself. The muscles which move the head, on the contrary, are designed to move the head, and for no further duty. The two cases therefore are not parallel.

head, a very frequent consequence of much desk-work, is almost always accompanied by more or less roundness of the shoulders. The exercise we are about to describe is designed to remedy this double deformity.

Fig. 46.

Standing upright, with feet together, shoulders square, and head erect, interlace the fingers behind the body, palms downward, as shown in Fig. 46. Retract the head strongly, tilting it well back and elevating the chin,* and stiffen the arms throughout their whole length (thereby drawing the shoulder-blades together), at the same time inhaling strongly. Relax the strain, and let the head go forward; repeating until the muscles are thoroughly tired.

The drawing back of the head and straightening of the back exercise the muscles known as the *erectores spinæ;* and the strain put upon the shoulder-blades the *trapezius* and the *rhomboideus major* and *minor,* between the

* As Blaikie has well pointed out (*How to get Strong*, p. 246), the mere throwing back of the head of itself tends to elevate the front of the chest. But to get the *maximum* benefit from the movement, the shoulder-blades must at the same time be drawn together.

shoulders. The strengthening of these muscles will in time draw back the neck and shoulders to their proper position, while the simultaneous inhalation will gradually expand the lungs and chest, which are of necessity contracted by the "stooping" habit.

EXERCISE 4.—In similar cases much additional benefit will be obtained from the daily practice of the following exercise.

Standing upright, with shoulders squared, cross the arms behind the body, each hand grasping the opposite forearm, as near to the elbow as possible, and the forearm pressed strongly into the hollow of the back. Throw the head well back and take a deep breath, when it will be found that of necessity the chest is expanded to its utmost limit. Then bend the body till it is nearly horizontal, at the same time exhaling the breath, but without allowing the shoulders to go forward, the strain of the arms keeping them in position. Then rise again, throwing the head as far back as possible, and hollowing the back, at the same time inhaling strongly.

This movement exercises much the same muscles as in the last case, but in a slightly different manner.

EXERCISE 5.—Standing with feet together and

hands on hips (see Fig. 10, p. 68), bend the body over to the right as far as possible (without any forward or backward inclination); then over to the left in like manner, and so on alternately.

This exercise develops the abdominal muscles, contributing greatly to an erect and graceful carriage of the body. It is also valuable as tending to reduce obesity, for the greater the development of muscle round the abdominal region, the less will be the accumulation of fat.* All exercises which flex the body on the *pelvis*,—a movement rarely required by the conditions of every-day life—have a special value for corpulent persons.

It will be observed that the exercise here described is in effect the same as Ex. PP with the pulley-weight apparatus. (See p. 125.) This is a case where the employment of such an appliance is practically a matter of indifference. The use of the pulley-weights of course increases the work done, but only in a slight degree, as they add but a small percentage to the weight of the trunk itself, the resistance of which causes the real stress of the exercise.

EXERCISE NN, p. 123 (bending the body over

* "Firm and vigorous abdominal muscles form the best 'girdle against obesity.'" *Lagrange: Physiology of Bodily Exercise* p. 277.

the toes, with arms extended, and then rising to the erect position), may in like manner be practised as a free exercise with little sacrifice of its effectiveness. This also has a special value in cases of obesity.

EXERCISE 6.—This is practically identical with dumb-bell Exercise G. (See p. 74.) Stand upright, with the feet together, hands clasped together, arms stiff and extended straight to the front. Now turn the upper part of the body as far to the right as possible, then to the left in like manner.

This is a very useful exercise for the abdominal muscles and rotators of the spine. But it has a further and special virtue in the fact that it produces a sort of internal *massage* of the stomach and bowels, and a quickening of the circulation in those parts, most valuable in cases of indigestion or chronic constipation.

With regard to the extension of the arms as above described we have followed Drs. Angerstein and Eckler.* The position suggested has its advantages, in so far as the swing of the extended arms helps to carry the body round from side to side, but it is by no means an essential part of the exercise, which may be performed with hands on hips, if preferred, without any material sacrifice of effectiveness.

* *Haus-Gymnastik für Gesunde und Kranke.* Berlin, 1890.

Exercises S (dumb-bell) and JJ (pulley-weight), (pp. 87, 119), may in the same way be practised empty-handed, and will be found very beneficial, though in these two cases the downward pressure of the dumb-bell or pulley-weight very decidedly enhances the effect of the exercise, as the novice may readily satisfy himself by testing it under both conditions. He will find that the feeling of local fatigue, which is the evidence that the exercise has produced the desired effect on the muscle, will in the one case be produced in two-thirds (or less) time than in the other.

Fig. 47.

The legs, with most people, are far better developed than the arms, by reason that the most indolent person perforce gives the former a certain amount of exercise, which, from the fact that they have to carry the weight of the body, is relatively of a severe kind. The exertion of a heavy person in ascending two or three flights of stairs represents an amount of work which, if required to be done with the arms, would be regarded as impossible.* But the leg

* Lagrange takes the case of a man, weighing say 150 lbs., taking two minutes to ascend a staircase twenty yards in height,

muscles are *intended* to do heavy work, and, as a rule, get far less of it than they ought to have, to keep them in thorough condition. We therefore proceed to describe one or two leg exercises.

EXERCISE 7.—Stand beside a fairly heavy chair, the left hand grasping the back. The body being thus steadied, support yourself on the left leg, and extend the right leg as far as possible to the front, at the same time pointing the toe downwards. (Fig. 47.) Then, still keeping the leg stiff, draw it back, as shown by the dotted lines, at the same time bending the toes upwards. Repeat until the leg is thoroughly tired; then grasp the chair with the other hand, and repeat the exercise with the left leg.

The use of the chair is merely a concession to inexperience. So soon as the novice can perform the exercise without its aid, he should do so, as the additional effort of keeping the body balanced has a very beneficial influence on the muscles of the spine and abdomen.

This exercise is in fact the balance-step, profanely spoken of by Thomas Atkins as the "goose-step;" but let not the neophyte despise it for its

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This seems no great feat, but he will thus in two minutes have raised a weight of 150 lbs. 60 feet, or, in other words, have done work equal to 9,000 foot-pounds. This is the same thing as if he had within two minutes lifted thirty 100 lb. weights, or sixty 50 lb weights, and placed them on a table three feet high.

homely name, for it employs a singularly wide variety of muscles, and contributes perhaps more than any other form of exercise to improve the walk, and build up a strong and shapely leg.

The forward movement of the thigh exercises the *psoas magnus* and *iliacus* (the large muscles on the front of the thigh), and the rearward movement the *glutcus maximus*, the muscle of the buttock. Meanwhile the pointing of the toe in the forward movement exercises the muscles of the calf (*gastrocnemius* and *soleus*), and the elevation of the toes in the backward movement the *tibialis anticus*, the corresponding muscle on the front of the leg. The extensors of the knee-joint also participate in the work, and gain proportionate development.

EXERCISE 8.—Standing with the feet together, and holding on to the chair as before with the left hand, raise the right leg, keeping it stiff at the knee, *sideways* as high as you possibly can, then let it sink slowly down to its former position. It must be kept throughout the movement in the plane of the body; for if allowed to bend forward, as it will have a natural tendency to do, the work will not wholly fall on the muscles which it is intended to benefit, viz., the *glutcus medius* and *minimus*, the abductors* of the thigh.

* See note on p. 46.

EXERCISE 9.—This is the converse of the preceding exercise. The chair is not here needed, as a very little practice will give the necessary balance, and the abdominal muscles will profit by the effort necessary to obtain it.

Fig. 48.

Stand with the feet together, one hand on each hip. Bring the right leg, fully extended, across the left, and let the toe (which should be kept well pointed) touch the ground about twelve inches beyond the left foot, as shown by the dotted lines in Fig. 48. Then draw the foot back and let it touch the ground at the furthest attainable point on the opposite side. Continue until the limb is tired, and repeat in like manner with the opposite leg.

This movement exercises the *adductor* muscles of the thigh, or those muscles which draw the thighs together. These are the muscles which mainly contribute to a firm seat on horseback, and consequently in persons who ride much are likely to be well developed, but save in this one instance they get but little work to do, and suffer accordingly.

EXERCISE 10.—Standing with hands on hips,

bend the right knee, and draw up the heel as near to the buttock as possible. Continue till the leg is thoroughly tired; then repeat with the opposite leg.

This movement distributes a good deal of work among the flexors and extensors of the leg, but its main effect is to develop what is known as the "*biceps*" of the thigh, the large muscle immediately in the rear of the limb, which performs the same office with regard to the leg which the *biceps cubiti* does for the arm.

EXERCISE 11.—Standing with heels together and hands on hips, slowly sink down by bending the knees *laterally* (not to the front) as far as you possibly can, then slowly rise again to the erect position. (See Fig. 21, dumb-bell exercises.) This movement exercises the *sartorius* or "tailor's muscle," a muscle which in ordinary life gets very little employment, and degenerates accordingly.

EXERCISE 12.—We will now proceed to describe an exercise of a different kind, and considerably more severe than any of the foregoing. Take a couple of strong dining-room chairs (the more upright the better), and place them back to back just so far apart that, with a hand resting on each, you can stand comfortably

between them. Standing with the hands as above described, and bending your knees so as to lift the feet off the ground, let yourself sink down two or three inches by flexing the arms, and then raise yourself again by extending them. This sounds easy enough, but it is extremely hard work to an unpractised person, even though of considerable general strength.* Facility, however, will come with practice. The length of the "dip" will gradually increase till the shoulders sink considerably lower than the elbows, and the possible number of dips will increase in like manner.

When the novice has attained a reasonable degree of facility in the "arm" portion of the work, the legs should next receive their share of training. Instead of being bent backwards in the kneeling position, they should be kept straight at the knee, and flexed at the hip, rising to the front till they are at right angles with the body. (See

* Blaikie (*Sound Bodies for our Boys and Girls*, p. 45, says, "The writer, in 1879, saw Hanlan, the famous oarsman, try to do a few "dips." Although very powerful in the muscles he rowed with, yet when at first he dipped down till his knees touched the floor, he actually could not rise up once. A few months after we saw him try again. He dipped fairly twice. At the third dip he got down till his elbows were bent, but could scarcely straighten up again at all, and stopped. And yet this same Hanlan is one of the greatest rowers the world ever produced,—indeed, was long the champion oarsman of the world. And in the muscles most used in rowing, those of the loins, the broad of the back, the abdominal muscles, and those of the forearms, the front of the thighs, and of the calves, he is a very strong man."

Fig. 49.) This leg movement may be practised in the first instance with the arms held vertical, but when habit has made it fairly easy, the "dip" should be practised with the legs in this position.

Fig. 49.

The same exercise may be practised from the sitting position, the performer placing himself in a sufficiently strong armchair, and raising and lowering himself by resting his hands on the arms, the legs being held as above described.

The above will be recognised by athletes as one of the earliest, but by no means the least valuable, of the exercises performed on the

parallel bars. The "arm" portion of the exercise is unsurpassable for the development of the *triceps*, while the raising of the legs to the "half-lever," as it is called, is equally beneficial to the abdominal and hip muscles, which, as a rule, get far less than their fair share of work.

It would be easy to enlarge this list of "free" exercises to an indefinite extent. It is obvious that the whole range of dumb-bell exercises, for instance, might be performed empty-handed, though to do so would, as we have said, be unwise; as employing the time available for exercise to comparatively small advantage. We will conclude this chapter with the description of a valuable little exercise (13) for developing the muscles of the forearm, though it scarcely comes within the category of "free" exercises, inasmuch as it involves the use of a small item of apparatus, in the shape of a couple of short pieces (say four inches long) of india-rubber tubing, one and a quarter to one and a half inches in diameter. Grasping these one in each hand, with the elbows close to the sides, and the forearms extended horizontally and parallel to each other in front of you, palms upwards, rotate each hand inwards till they are turned palms downwards, at the same time squeezing the rubber tubes with the full force of the hand. Then again turn the wrists outward,

simultaneously relaxing the grip of the hand. Repeat until the aching of the forearm compels you to desist.

This apparently trifling movement exercises two different sets of muscles, the half turn of the wrist employing the *pronator* and *supinator* muscles, and the gripping movement the *flexors* and *extensors* of the fingers. But you have not yet done. Now take the tubes between the fore-fingers and thumb of each hand, and press with these. This brings into contraction a muscle which has hitherto taken no share in the work, the *flexor longus pollicis.*

This muscle, with those employed in the last exercise, together make up the fleshy portion of the forearm, just below the elbow, and if these receive due employment (for which purpose the above two exercises are amply sufficient), a strong and shapely forearm will be the sure result.

CHAPTER X.

HOME GYMNASTICS FOR WOMEN AND CHILDREN.

Among the various exercises already described, there is scarcely one which may not be used to advantage by any person, without distinction of sex or age, always provided that, if dumb-bells or pulley-weight apparatus be used, the amount of resistance to be overcome shall be duly proportioned to the strength of the person attempting it. In the case of the pulley apparatus the weight may for a woman or child be from two to six pounds. In the case of dumb-bells one or two pounds each will be found amply sufficient. Wooden dumb-bells, of the pattern illustrated in Fig. 3 (p. 51), are to be preferred, iron bells being less satisfactory to handle in very small sizes.

Besides the above, however, there is another class of exercises which has a special suitability for persons of delicate frame and slight muscular development. We refer to those performed with the *Wand.*

The Wand, for persons of five feet and upwards in stature, should be four feet in length, and

three-quarters of an inch in diameter.* For children, it may be six inches less in length, and $\frac{5}{8}$ inch diameter. It may be made of any kind of light wood (ash, for choice), and should be *polished.* This not only makes it more comfortable to handle, but keeps it clean; an unpolished wooden surface very quickly becoming soiled. A good polished wand should not cost more than sixpence or eightpence. Unpolished, a wand may be had for half that price.

WAND EXERCISE 1.—Stand with heels together, toes turned out, head and chin up, shoulders square. Arms hanging down perpendicularly at sides, grasping the wand as shown in Fig. 50. This is the position of "Attention."

Raise the arms perpendicularly as shown by the dotted lines, getting them as far back as possible, and at the same time hollowing the back. Then let them sink down to their former position.

Meanwhile, the management of the breath

* For men's use, the wand is sometimes made five feet long, but four feet is amply sufficient. At the German Gymnasium a round iron bar is substituted for the wooden wand. The amount of work done in each exercise is naturally made much heavier thereby, but the substitution is of doubtful advantage. In the wand exercises the element of *weight* is not needed, the rigidity of the wand, keeping the hands at a uniform distance from each other, supplying the needful "resistance." Further, the primary object of the wand exercises is to impart, not great strength, but agility, though the acquirement of the latter necessarily promotes that of the former.

should receive attention. Inhale as the arms rise. Exhale as they fall. Do this ten times. Then repeat ten times more,* holding the breath, with

Fig. 50.

the chest fully expanded, as long as you conveniently can, taking care however always to inhale with an upward, and to exhale with a downward movement. This rule may be regarded as appropriate to the whole series of these exercises.

* The actual number may be made less or greater at pleasure. It is often hard work at the outset to perform an exercise ten times which after a little practice can easily be performed fifty times.

[Principal muscles exercised: The *deltoid, pectorales,* the flexors and extensors of the arms, and the respiratory muscles.]

WAND EXERCISE 2.—Commencing from the position of Attention, let the hands travel outwards

Fig. 51.

along the wand till they are about two feet three inches apart.* (Fig. 51.) Raise the arms as before till the wand is above the head, then lower them by bending the elbows till it rests on the shoulders, passing *behind* the head, as shown by

* No precise rule can be given as to exact distance, for it will vary with the stature of the operator, but it should be such that when the wand is lowered behind the head, as shown in Fig. 51, the forearms shall be exactly vertical.

the dotted lines. Raise it once more above the head, and bring it down to the front, as at first. Repeat at pleasure.

[Principal muscles exercised: The *deltoid, pectorales, trapezius, rhomboideus, latissimus dorsi*, and the respiratory muscles. The forcing back of the shoulders by the lowering of the wand behind the head has a wonderful effect in expanding the chest.]

WAND EXERCISE 3.—Standing at the posture of Attention, carry the hands a little further towards the ends of the wand, and proceed as directed for the foregoing exercise, but instead of letting the wand rest on the shoulders, force it past them in a downward direction till it is as shown by the dotted lines in Fig. 52. When it reaches this position, the palms will be to the front, the wand being supported by the thumbs only. Raise it again, and bring it down to the front, as at first.

You must be careful to let the wand sink down *horizontally*, neither end being in advance of the other. To ensure this, and indeed correctness in the movements generally, it is well to practise at the earlier stages before a looking-glass.

At the outset you will find this a difficult exercise, and only to be performed with the hands grasping *the extreme ends* of the wand. After a

little practice you will be able to manage it with the hands nearer and nearer together, and you should endeavour to achieve this, for the closer the hands

Fig. 52.

are together, the greater will be the effect of the exercise as regards the expansion of the chest.

[Principal muscles exercised: As in the last case, with the addition of extra work for the rotator muscles of the shoulder, and the *latissimus dorsi.*]

WAND EXERCISE 4.—Standing at Attention, raise the arms perpendicularly as shown in Fig. 50.

Then, still keeping the arms extended, bend the body so as to bring the wand over the toes within six inches of the ground. Rise slowly up again, getting the wand as far back as possible, and hollowing the back. Repeat *ad libitum.*

[Principal muscles exercised: The *deltoid*, erectors of the spine, and abdominal muscles.]

WAND EXERCISE 5.—Holding the wand in the same way, *i.e.*, with arms parallel, elevate them above the head, then bend the body to the right, without leaning forward (Fig. 53),* till the wand is brought as nearly as possible perpendicular. Then bend over to the left in like manner, repeating the movement as long as strength will permit.

[Principal muscles exercised: The abdominal muscles, *deltoid*, and the extensors of the arms.]

The last two exercises may if preferred be worked in alternate sequence, thus: (1) bend forward; (2) rise to upright position; (3) bend over to right; (4) bend over to left; (5) return to upward position. Repeat in above order.

WAND EXERCISE 6.—Holding the wand as before, with arms parallel, elevate them above the head,

* In Exercises 5, 6, 7, the head will naturally move with the body, but it would have confused the diagrams to have endeavoured to indicate this by dotted lines.

at the same time turning the body to the left as far as possible. Drop the wand to the horizontal (bringing the body back to the front), and again

Fig. 53. Fig. 54.

raise it on the right side, turning the body in that direction. (See Fig. 54.) Repeat *ad libitum.*

[Principal muscles exercised: The *deltoid, pectorales,* extensors of the arm, rotator muscles of the spine, and abdominal muscles.]

The above will be found a rather fatiguing movement, if long continued. Should it prove too much for the strength of the operator, the

exercise next following may be substituted, with the same advantage, so far as the effect on the abdominal region (which is the most essential element of the exercise) is concerned.

Fig. 55.

WAND EXERCISE 7.—Starting from the position of Attention, raise the arms (still keeping them extended) till the wand is level with the chest. (See Fig. 55.) Then without moving the feet, turn the body to right and left alternately, as shown by the dotted lines.

The muscles here exercised are principally the abdominal, but the chief benefit of the movement

arises from the sort of *massage* thereby exercised on the stomach and intestines.

WAND EXERCISE 8.—From the position of Attention, let the hands travel along the wand till they are within an inch or so of the respective

Fig. 56.

ends. Raise the arms, as in Fig. 52, then lower them so as to bring the wand behind the head, as shown in Fig. 51. Bend the left arm, and extend the right, as shown in Fig. 56, then bend the right arm and extend the left in like manner (see dotted lines), so as to shoot out the wand to right and left alternately.

[Principal muscles exercised: This movement affords excellent work for the *trapezius* and *rhomboideus* (the muscles between the shoulders) and the flexors and extensors of the arms. It is likewise extremely valuable for expanding the chest, and correcting a stooping habit.]

Fig. 57.

N.B. The same exercise may be performed with the wand in *front* of the body, but it is less effective in that shape. The work done by the arm muscles is the same, but the effect on the chest is much less beneficial.

WAND EXERCISE 9. — Holding the wand, as last directed, with the hands within a couple of inches of the ends, bring the left hand close to the side (the arm hanging straight down), and the right arm across the body about the level of the forehead, so that the wand shall be perpendicular, as shown in Fig. 57. Then reverse the position, raising the left arm, and lowering the right, till the wand assumes a similar position on the opposite side of the body. The shoulders should be kept level, and the body upright, throughout the operation.

[Principal muscles exercised: The flexors and extensors of the arms, and the intercostal muscles.]

WAND EXERCISE 10.—Hold the wand as shown in Fig. 57, left hand down, right hand across the body. Pass the right arm over the head, and lower it behind the body till the wand reaches the horizontal position; then raise the left arm, bring it over the head, and so bring the wand first to the vertical position on the right side, and then to the horizontal position in front.

Repeat at pleasure. When you have completed half the intended number of movements, vary by working the wand round and over the body in the opposite direction.

[Principal muscles exercised: Generally speaking, the same as in the last exercise, but more vigorously, and with more marked effect on the rotator muscles of the shoulders. The restriction as to keeping the body upright and shoulders level may in this instance be disregarded, this exercise being designed to impart elasticity rather than strength of fibre.]

There are many other movements performed with the wand, but those we have given will be found to cover all that is really essential in this particular direction.* The remainder are mostly

* The same series of movements is equally adapted for use with the French dumb-bell or bar-bell, a wooden or iron bar, with a

of a "fancy" nature, arranged chiefly for prettiness of effect in the "mass" exercises of the Gymnasium, of which they form one of the most picturesque elements.

Before finally quitting the subject of gymnastics for women and children, we must not omit to call attention to the virtues, in a hygienic sense, of two very familiar playthings, the *ball* and the *skipping-rope*.

Few people are conscious of the amount of genuine work done in five minutes of brisk skipping. Dr. Lagrange says, "Let us suppose that a little girl is amusing herself by skipping. It is easy to jump one-tenth of a metre high* one hundred times a minute. The work done, therefore, will be equal to an expenditure of force capable of raising her body to a height of ten metres.† Now there are not many gymnasts who could climb with their hands alone to a height of ten metres in a minute; and there is not probably one who could go on climbing for three minutes at this pace, while there are many little girls who can skip for five minutes or more without stopping.

"In the act of skipping, the work is not done

ball at each end, but as we have already stated (p. 149), we do not consider that the additional resistance of "weight" is any advantage in this class of exercise.

* *Physiology of Bodily Exercise*, p. 232. Approximately, four inches.

† A little over thirty-three feet.

by the same muscles which are used in climbing a rope, so the local effect of the two exercises will be different. But if in both exercises the number of *kilogrammètres** of work is the same, the general effects of the work will be identical, for the changes in the great organic functions, and particularly the changes in breathing, are in direct ratio to the sum total of work done in a given time. Now, in the application of exercise to hygiene, the general effects of work are especially sought; we wish to render the blood-currents more active, to increase the power of the respiratory movements, and, in a word, to associate all the great organic functions of the economy in the work."

It is clear that by the act of skipping a very large number of muscles, belonging to arms, legs, and trunk, are brought into rapid and energetic contraction. The effect on the respiratory organs is also very marked, as any one unaccustomed to this particular exercise may readily satisfy himself, by trying the experiment. Indeed, Lagrange advises, in another passage, "When a young person has a narrow and flat chest, recommend running if a boy, skipping if a girl."

* In England the unity of measurement, for estimating quantity of work, is the "*foot-pound*," *i.e.* the amount of force expended in raising a weight of 1 lb. through a space of 1 foot. In France the unit of measurement is the "*kilogrammètre*," *i.e.* the amount of force needed to lift a weight of one *kilogramme* (a little over two lbs. three ounces) through a space of one *mètre* (about 40 inches).

Nor must it be supposed that skipping is an exercise only suitable for children, though it undoubtedly has a special appropriateness in their case. A child skipping is always a more or less graceful object, whereas a stout elderly gentleman or lady exercising in the same way would hardly come within the same description. Of its value for athletic purposes, however, there can be no doubt; indeed, so eminent an authority as the late Charles Westhall specially recommends it to pedestrians in training, as a means of getting rid of superfluous fat. After referring to the efficacy of walking exercise for this purpose, he goes on to say,*—"If the weather be unfavourable, a bout at the dumb-bells, or half-an-hour with a skipping-rope, parallel bars or vaulting bars, will be found not unfavourable as a good substitute. The value of the skipping-rope, as a means of exercise on a bad day, is not well understood by amateurs. Clothed in flannels, the weight comes off very rapidly, while the exercise to the leg muscles is very beneficial. Skipping need not by any means be a monotonous exercise, for there is much scope in it for the exercise of skill and variety. Even when the weather is not bad, an hour's skip in the back-yard or garden is

* *Training: for Running, Walking, Rowing, &c.* By Charles Westhall, late Pedestrian Champion of England. Revised and enlarged by E. T. Sachs. Ward & Lock, 1890.

a very expeditious method of taking off weight in a natural way, which is the safest."

Equally valuable, in another direction, is the "ball." Mr. Alexander has even elevated "Ball Practice" to the dignity of regular gymnasium work, and has compiled a series of mass exercises* for its use. The ball recommended by him is the familiar hollow rubber article, five inches in diameter. This is a handy size, being about the maximum that can be conveniently grasped by one hand. For home use the following will be found very beneficial exercises.

BALL EXERCISE I.—Stand erect, with the feet at right angles, heels about fifteen inches apart, head up and shoulders square, arms close to sides. Take the ball in the right hand, elbow bent, finger-nails upwards. Toss it straight upward to within a foot of the ceiling, and as it falls, catch it *overhand* with the same hand.

BALL EXERCISE II.—Repeat the same process, but with the left hand instead of the right.

BALL EXERCISE III.—Toss the ball with the

* *Modern Gymnastic Exercises.* Part II. Advanced. By A. Alexander, F.R.G.S. (Geo. Philip & Son, 32, Fleet St.) Mr. Alexander recommends that the ball be painted red, which doubtless adds to prettiness of effect; but for home use we think the plain grey rubber preferable.

right hand as above directed, and catch it with the left.* Then toss with the left, and catch it with the right.

BALL EXERCISE IV.—Taking a ball in each hand, toss them simultaneously, catching each with the same hand.

BALL EXERCISE V.—Taking a ball in each hand, toss them simultaneously, but so as to cross each other, and catch each as it falls *with the opposite hand.*

BALL EXERCISE VI.—Taking one ball only, let it drop on the floor, and as it rebounds beat it down again (without catching) with the right hand, held flat, palm downwards. As it again rises, again beat it down, counting as you do so, and striving to keep it up as long as possible.

BALL EXERCISE VII.—Repeat with the left hand.

BALL EXERCISE VIII.—Repeat, using each hand alternately.

BALL EXERCISE IX.—Take two balls, and using both hands, repeat with both simultaneously.

* As the operator advances in dexterity, he may increase the difficulty of the exercise by holding the hands farther and farther apart, so that the ball shall describe a wider arc in falling.

Where a second person can be induced to take part, the exercises may be varied by throwing the balls from the one to the other, first singly, then simultaneously. Specific directions are in this case scarcely necessary. The exercise now takes the form of a "game," but without any detriment to its hygienic value, nor need the dignity of the most serious suffer by taking part in it. If it can be played out of doors, so much the better, as there will not only be a more plentiful supply of oxygen to the lungs, but greater space for active movement.

The above exercises, energetically carried out, will be found to involve an amount and variety of movement which would hardly be believed by any one who has not actually tried the experiment. The muscles of the arms and legs take the most direct part in the operation, but besides these, the constant following the ball with eye and hand involves a perpetual hither and thither movement of the abdominal and neck muscles (which in the ordinary avocations of life get by no means their fair share of exercise), and the work thrown upon these muscles will be found most beneficial, not merely in reducing obesity, but as promoting an easy and graceful carriage.

CHAPTER XI.

EXERCISE IN RELATION TO OBESITY.

Among the many conditions in which systematic bodily exercise will be found beneficial, there are none in which its use is, in medical phrase, more clearly "indicated" than in cases of obesity. While the spare man *may* be benefited by a course of moderate gymnastics, the corpulent man *must*. Exercise is Nature's prime remedy for his ailment. In nine cases out of ten, the neglect of exercise has been a main factor in producing his morbid condition, and conversely, exercise, if sufficient in quantity, and long enough continued, will, unassisted, effect a cure. Blaikie (*How to get Strong*, p. 157) cites the case of a middle-aged man of his acquaintance, who, from a weight of 305 pounds, without any other change in his mode of living, in five months reduced himself to 215 pounds, simply by walking at his best pace, each evening after his day's work was done, from three to five miles. The only remarkable point about the story is the strength of mind which enabled the patient to persevere in so heroic a

treatment; for it must be remembered that the condition which it was designed to cure is the one of all others to render such a remedy distasteful. For a man in middle life, carrying over a hundredweight of superfluous fat, to carry out such a course of training, shows an amount of resolution which we fear is likely to find but few imitators.

Fortunately, however, the corpulent man, desiring that his "too, too solid flesh would melt," is by no means compelled to adopt so painful a remedy. We have said that in such cases, want of exercise is usually a main factor, but it is rarely the only factor; the second cause being indiscretion in diet. Such indiscretion is very probably in quality rather than quantity. It is by no means a matter of course that a corpulent person should be a very large eater (indeed, the case is often the reverse), but in the words of the old adage, "what is one man's meat is another man's poison," and foods which, to a man of spare habit, are not only harmless but beneficial, may be directly injurious to his more corpulent brother, by overloading his system with those superabundant reserve materials which exercise, as we have seen (p: 20), converts into active poisons. It is therefore neither necessary nor wise to call upon exercise alone to undo a state of things which lack of exercise has only partly created. Exercise alone will produce the desired effect, but

the cure will in such case be long and painful, whereas, if moderate but regular exercise be supplemented by an amended dietary, it may be made comparatively easy and pleasant.

It will be within the memory of most readers that in the year 1863, a worthy gentleman, Mr. Banting, who had been a special sufferer from excess of fat, and had tried all sorts of expedients, including a bread-and-milk diet (!), to reduce it, published a pamphlet detailing the means which ultimately relieved him of what he poetically termed his "parasite," and in twelve months reduced his weight from 202 to 156 pounds, his diminution of girth during the same period being 12¼ inches. The dietary by which he effected this remarkable change was as follows :—

For breakfast.—Four or five ounces of beef, mutton, kidneys, boiled fish, bacon, or cold meat of any kind, except pork; a large cup of tea, without milk or sugar, a little biscuit, or one ounce of dry toast.

For dinner.—Five or six ounces of any fish except salmon, any meat except pork, any vegetable except potato; one ounce of dry toast, fruit out of a pudding, any kind of poultry or game, and two or three glasses of good claret, sherry, or madeira.—(Champagne, port, and beer forbidden.)

For tea.—Two or three ounces of fruit, a rusk or two, and a cup of tea without milk or sugar.

For supper.—Three or four ounces of meat or fish, similar to dinner, with a glass or two of claret.

For night-cap, if required, a tumbler of grog (gin, whisky or brandy, without sugar), or a glass or two of claret or sherry.

It will be seen that the regimen was by no means one of starvation, the only articles specially tabooed being bread, butter, pastry, milk, beer, sugar, and potatoes. The pamphlet attracted an extraordinary degree of attention. The doctors declared that there was nothing new in the treatment. They knew, they said, all about it before, but if so, they had with singular unanimity refrained from communicating the secret to their patients. Mr. Banting had at any rate the credit of calling public attention effectually to the subject, and of having proved, in his own person, that the evil was not without a remedy. Since his day, medical science has advanced in this as in other directions, and the principles foreshadowed in what is familiarly known as "doing Banting" have been carried very much farther—to an extent, indeed, which Banting himself never dreamed of.

The most drastic regimen for the reduction of obesity is that known as the "Salisbury" System, after the American physician who originated it. Strange to say, however, the use of the Salisbury treatment for this particular purpose is a sort of afterthought, an addition engrafted by later scientists

on the stock of the original inventor.* Dr. Salisbury's special work is a treatise on *The Relation of Alimentation to Disease*, embodying the results of a life-long series of experiments on the influence of various diets in curing or producing disease. Its special object was to establish an effective treatment for certain dyspeptic and kidney disturbances, which, according to the author, lie at the root of half the ailments flesh is heir to. Dr. Salisbury maintains that such ailments arise mainly from the formation (in the stomach and intestinal canal) of certain products (notably lactic, acetic, butyric and saccharic acids, and certain gases) which, if not rapidly and completely eliminated from the system, poison the blood, and lay the

* Almost the only allusion in Dr. Salisbury's book to the loss of weight consequent on the adoption of his system is in the terms following (p. 172):—"Never mind the shrinkage in weight. It is natural and absolutely necessary, for the reason that those foods which upholster, or make fat, are the very ones which produce the disease. The weight-decrease is not at all dangerous or alarming, when from the blood examinations it is readily seen that the blood is constantly improving in quality and increasing in quantity. The patient will begin to make new and firm healthy tissue at a later stage of his cure, when normal blood-making processes are fully restored. The tissue with which he has parted—devitalized and enervated—is no loss, and must give place to that of the new order of things."

From the above extract it will be seen that the reduction of weight is regarded by Dr. Salisbury as a mere accident of his system, and by no means one of its special objects.

foundation of various morbid conditions. Much of the mischief arises from a yeasty fermentation,* which, once set up in the stomach, tends to perpetuate itself, and by the constant production of carbonic acid gas keeps the mucous membranes in a slimy catarrhal condition. The excessive formation of mucus thereby caused in the stomach and duodenum impedes the due performance of their functions, and every fresh supply of food introduced into the system thus clogged tends to aggravate the evil. Dr. Salisbury's treatment is directed in the first place to clear the system of this yeasty secretion, and in the second to prevent its re-appearance. The first desideratum he claims to effect by the administration of copious doses of hot water; the second by the adoption of a novel and somewhat startling regimen in point of diet.

The hot water is taken in four doses of one pint each, the first dose on rising in the morning, the last just before retiring to rest, and the other two an hour or an hour and a half before luncheon and dinner respectively. The water should be as hot as can be borne without inconvenience, say 110° to 150° Fahrenheit; and not taken at a draught, but slowly sipped, so as not to distend the stomach. The selection of the

* It should be stated that this "yeasty" theory is by no means fully accepted by English medical men, even though following Dr. Salisbury's methods.

hours indicated ensures that it shall be taken as nearly as possible on an empty stomach, the digestion of the last preceding meal being by that time practically completed. Its function is threefold: to aid the dispersion of any residuum of the food last taken, to wash away the yeasty secretion above referred to, and, last but not least, to dilute, to the point of solution, certain matters which otherwise tend to accumulate in the system, and to set up a morbid action therein.*

So much for the "hot water" portion of the treatment, to which comparatively little exception is taken, it being conceded—even by those who do not admit that it does any good—that it cannot very well do any particular harm. It is the dietetic portion of the system which most clashes with old-fashioned medical ideas, and has excited the keenest controversy. Dr. Salisbury asserts that the yeasty fermentation, above referred to, is produced mainly by vegetable and saccharine elements, and these accordingly he taboos, for a season, *in toto*, afterwards permitting

* Amongst these we may instance uric acid, which requires no less than eight thousand times its weight of water, at the temperature of the blood, to hold it in solution. If the quantity of fluid taken is insufficient, the acid crystallises, and gout, gravel, and other disorders are the necessary consequence. It is true that the solvent fluid might be taken in the shape of *cold* water, but the body would then have to provide the needful heat to raise it to the required temperature, and there is therefore an economy of vital force in administering it already heated.

them to a limited extent, but in very small proportion compared to the ordinary consumption of most persons; the proper or "normal" diet of man, according to him, consisting of two-thirds animal to one of vegetable food. For the first few weeks of treatment (varying in number according to the circumstances of the particular case), absolutely *no* vegetable food is to be eaten. The only food permitted is *lean* rump steak, free from skin and fat, not even bread being allowed during this earlier stage. On the other hand, no limit is laid down as to *quantity*, and the patient may, if he pleases, take a full pound or even more of solid meat at each meal.*

It is an undoubted fact that any one adopting the all-meat system in its entirety will find his weight diminish with extraordinary rapidity, a loss even of two or three pounds a week being by no means exceptional. We have no reason to believe that the patient's health would be likely to suffer even from the strictest observance of the regimen indicated,† but we cannot speak on this

* A considerable increase of quantity is inevitable. A patient who would find it difficult to get through half a pound of steak with the usual accompaniment of bread and vegetables, will without difficulty eat a whole pound alone, and have a good appetite for the next meal. This arises not merely from the meat alone being more quickly digested, but from the fact that the stomach is not distended by the gases arising from the usual "mixed diet."

† We cannot say as much for the much advertised quack remedies for obesity, which may be ranged under two categories,

point from personal knowledge. With regard, however, to the effect of the same dietary *plus* a

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the absolutely inert, and the actively injurious. A little reflection will convince the reader that such is likely to be the case. In these analytical days it is impossible to keep the composition of an alleged remedy a secret, and were there any drug or combination of drugs which would cure obesity without injury to the constitution, it would be eagerly adopted and prescribed by medical men. As a matter of fact, every honourable practitioner will frankly admit that *he knows of no drug which will directly remove superfluous fat, except at the cost of injury to the general health.*

Some of the advertised nostrums are preparations of iodine, a drug which will undoubtedly cause waste of tissue, but too frequently in directions where it is least desired. In other cases a show of good faith is made by giving the "prescription" itself, accompanied by a hint that if the purchaser finds any difficulty in getting it made up by his own druggist, he can have a supply of the genuine article from the advertiser for a sum named. Now one of two things usually happens. Either the chemist undertakes the task (in which case the very probable failure of the mixture is laid by the advertiser to some fault in the mode of preparation), or, more frequently, he frankly says that it includes some drug of which he never heard. In either case the victim, determined to have the right thing, ultimately applies for it to the benevolent advertiser, and is fortunate if the mere waste of his money is the only penalty he pays for his folly.

It should, to a prudent person, be presumptive evidence of fraud that the advertisement, or the prospectus which follows it, almost always states as a recommendation that no change of diet or increase of exercise is necessary, thereby discarding the two most effective *bonâ fide* methods of fat-reducing treatment.

A word of caution may be usefully added against the use of *vinegar* as a means of reducing fat. Dr. Salisbury quotes (p. 210) a case from the *London Medical Gazette:* "A young lady in easy circumstances, enjoying good health, was very plump, had a good appetite, and a complexion blooming with roses and lilies. She began to look upon her plumpness with suspicion; her mother being very fat, and she afraid of becoming like her. Accordingly she consulted a woman, who advised her to drink a small glass of

very slight admixture of vegetable food we can testify from direct experience, having, under skilled advice, made personal trial of it, in conjunction with a special course of Home Gymnastics,* and having derived therefrom the greatest benefit, not only in diminution of weight and girth,† but in improved

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vinegar daily. The counsel was followed, and the plumpness soon diminished. She was delighted with the success of the remedy, and continued it for more than a month. She began to have a cough, but it was at first dry, and regarded as a cold that would subside. But from being dry it was presently moist. A slow fever came on, with difficult breathing; her body became lame and wasted away; night sweats, with swelling of the feet, succeeded, and a diarrhœa terminated her life. On examination, all the lobes of the lungs were found filled with tubercles, and somewhat resembled a bunch of grapes."

The above is by no means an isolated case, as any medical man will admit. Dr. Salisbury, in the course of his experiments, placed four men, including himself, upon ordinary diet, but using vinegar mixed with sweetened water as their only beverage. From the third day the health of each began to deteriorate, and on the ninth the experiment had to be discontinued, the subjects one and all showing symptoms answering to those of Hog Cholera, a disease which Dr. Salisbury had already shown to be caused by feeding swine on the acid wash of the distilleries.

* See Preface.

† To the extent, in eight months, of 30 lbs. of weight, and four inches of waist measurement. The reduction might, no doubt, have been carried much further, but the diminution being regarded as sufficient, the strict rule of diet was exchanged at this point for a less stringent regimen.

It should be noted that the reduction of bulk is always most marked at the earlier stages of the treatment. So soon as the excess of fat has been got rid of, the diminution proceeds much more slowly. It is also a frequent occurrence (verified by the writer's own experience) to find the chest measurement diminish to

general health, and increase of bodily and mental energy.

the extent of two or three inches by reduction of fat, and afterwards again increase to nearly or quite the same extent, by the expansion of the chest cavity under the influence of daily exercise with the dumb-bells and pulley-weight apparatus.

With regard to the extent to which it is desirable to reduce weight, it may be worth while to quote the following table, given by Dr. Hutchinson, the originator of the "spirometer," in his pamphlet descriptive of that invention. Dr. Hutchinson, who was a leading authority on questions connected with Life Assurance, maintained that any marked defect or excess of weight beyond the normal standard affected the value of the "life." As a guide in such matters he framed this table, showing the average weights of 2,650 healthy males in thirteen different classes of society, at the middle period of life. It is stated that "no allowance is made for ordinary dress," which we take to mean that the weights given *include* those of the clothes in indoor use.

It will be noted that two different weights are given for each inch of stature. The first is the average or normal weight, the second the same *plus* an increase of *seven per cent.*, that being the limit to which Dr. Hutchinson found the normal weight could be exceeded without depreciation of the respiratory power. Beyond this limit, he states, "excess weight is disease." Theorists are, however, somewhat arbitrary in such matters, and we ourselves should regard any one who did not exceed the higher limit by more than half a stone as in very fair condition for all ordinary purposes of life. At the lower limit we should scarcely think it desirable to aim. Fat, as we have seen, constitutes a great part of the "reserves" of the body, and though excess of such reserve material is an evil, to have no reserve at all is equally objectionable, as the system is in such case not in a condition to meet any exceptional waste of tissue.

Stature.	Mean Weight.	Mean Weight increased by 7 per cent.	Stature.	Mean Weight.	Mean Weight increased by 7 per cent.
ft. in.	st. lbs.	st. lbs.	ft. in.	st. lbs.	st. lbs.
5 1	8 8	9 2	5 7	10 8	11 4
5 2	9 0	9 9	5 8	11 1	11 12
5 3	9 7	10 2	5 9	11 8	12 5
5 4	9 13	10 9	5 10	12 1	12 13
5 5	10 2	10 12	5 11	12 6	13 4
5 6	10 5	11 1	6 0	12 10	13 8

The following are the rules of the two-thirds or "normal" diet, as laid down by Dr. Salisbury.*

"Let all meals consist of two-thirds animal food, and one-third vegetable food. The proportions are to be by bulk, to be measured by the eye; broiled steak and ordinary baked potatoes being the best data for making allowances for articles having lesser density or more water. What I mean is that you could take, for example, without exceeding the one-third, a larger apparent bulk of boiled rice than you could of baked potato, on account of the separation of the rice grains and the water they have absorbed.

Chew vegetable food thoroughly. If it can be chewed until it is so reduced that it disappears, as it were, down the throat without any special effort to swallow, it will be perfectly masticated.

Eat always at the same hours.

Do not drink more than six ounces of liquid at a meal. The principal thirst should be slaked between meals, about an hour before meal-times.

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* We quote these rules as to the "normal" diet (which are intended to apply to persons in sound health) from a very instructive little pamphlet, entitled *Hot Water as a Remedy* (Simpkin, Marshall & Co.), by the late Dr. Butler of New York, one of the earliest and most enthusiastic exponents of the Salisbury system. The dietary instructions given by Dr. Salisbury in his special treatise, *The Relation of Alimentation and Disease* (and quoted *post*, p. 181), are designed to meet acute morbid conditions.

Dr. Butler's pamphlet contains, among other interesting matter, an account of various personal experiences of the system.

Do not eat or drink anything cold if it can be avoided. If obliged to take something cold, warm it, if possible, in the mouth by chewing or holding it there.

Do not eat manufactured sugar or products thereof, nor any dish or article prepared with the same.*

Do not drink liquids having carbonic acid in them, as soda, ginger ale, champagne, &c.

Eat and drink nothing of which the composition is unknown, or which is known to disagree with you.

Avoid malt liquors. An occasional glass of good sound still wine may be taken if it agrees, or some well diluted distilled liquor of best quality. But it must not be a daily practice.

Smoking, not to exceed one cigar after each meal, is permitted if it does not disagree.

Soups, pies, puddings, pastry, preserves,

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* Abstinence from sugar is a severe punishment to many people, but a satisfactory substitute is now found in *Saccharin* (one of the many coal-tar products), which possesses all the sweetening property of sugar without its fattening or fermentative properties. Messrs. Burroughs & Wellcome supply it in the shape of ½ grain tabloids (procurable of any chemist in bottles containing 25, 100, or 200 as required); also in a soluble powder, ¼ ounce in bottle, with microscopic "scoop." One to two tabloids or scoops full will effectually sweeten a cup of tea or glass of toddy. For sweetening acidulated drinks, stewed fruit, &c., the plain saccharin may be mixed with a small quantity of glycerine.

Messrs. Allen & Hanbury supply similar preparations.

candies, sweetmeats, cakes, nuts, raisins, dates, should be avoided. An occasional fig is allowed if it agrees.

No condiments allowed except salt, black pepper (use a French table pepper-mill), lemon juice (fresh), mustard, and horse-radish. A little genuine cayenne occasionally, especially if one has a cold in the head.

Vinegar must be banished.* Use fresh lemon-juice in all cases where vinegar was formerly employed.

Raw vegetables, such as lettuce, endive, radish, &c., should be avoided, with the sole exception of celery, which is permitted in moderation.

The pips, seeds, cores, and rinds of fruits and vegetables, and the fat, cartilage, sinew, and tendon of animal food, and things hard and indigestible in general are forbidden.

Oatmeal, and all other products of oats, and all products of maize, or Indian corn, must be avoided. Wheaten bread and boiled rice should constitute about all your grain food.

Fresh fruit is recommended, but strawberries, grapes, and pineapples should be eaten very sparingly, especially strawberries. When the rind of the fruit is eaten, or goes into the mouth, it should first be well washed.

* As tending to produce acetous fermentation in the stomach.

Live principally on roast or broiled meat, fish, poultry, and game, boiled rice, wheaten bread, potatoes baked in their jackets, butter, hot water, tea, and coffee. Eschew the fatter, oilier kinds; such as geese, ducks, salmon, eels. No pork.

Eat nothing *fried*.* No made sauces, stuffing, or dressing.

Avoid meats and fish that have been salted or smoked, except perhaps good dried cod-fish well soaked out.

A soft boiled or poached egg now and then, but not as a regular thing.

The watery, ligneous, and nitrogenous vegetables are allowed in small proportion once in a while. They can easily be dispensed with, being, with the exception of beans and peas, mostly for flavour only. . . . Such as have peculiar specific properties, as asparagus, spinach, onions, had better be avoided."

The foregoing regimen is intended for those persons who are already in normal health and condition. For those who are over-burdened with fat, with or without kidney trouble, the proportion of vegetable food is still further reduced. It may be useful to quote, for the further informa-

* This prohibition is, doubtless, on account of the butter, or other animal fat, which is ordinarily used in the process of frying. If fish or meat be fried in pure olive oil, it will be found quite unobjectionable.

tion of the too corpulent reader, the more stringent regimen recommended by Dr. Salisbury for patients suffering from diabetes or "Bright's" disease, which has a still more marked effect in the reduction of superfluous weight.

"DRINKS.—Drink from one half to one pint of hot water, one and a half hours before each meal and on retiring, drinking slowly.* . . . . Drink a cup (eight ounces) of clear tea, coffee, or beef tea (made of beef freed from fat and connective tissue) at each meal. When thirsty, between two hours after a meal, and one hour before the next, drink hot water, clear tea or beef tea freed from fat or gelatine. Take no other drinks of any kind. Should the hot water sicken the stomach, sprinkle in just enough salt to take away the flat taste.

"FOOD.—Eat the muscle pulp of lean beef, made into cakes and broiled.† . . . . For variety use also the steak (broiled) which is cut through the centre of a round (query, leg?) of lamb or mutton, broiled quail, broiled oysters, broiled

* See p. 171.

† Dr. Salisbury elsewhere gives instructions for the preparation of these cakes. They are to consist of the muscle only, freed from connective tissue, fat and cartilage. Steaks from the centre of the round are to be preferred. The lean muscle is to be first cut up in pieces an inch or two square, and then minced to a pulp. This is to be lightly pressed into cakes from half an inch to an inch thick, and then broiled slowly, till moderately well done, over a clear fire.

grouse, broiled woodcock, broiled snipe, broiled partridge, and broiled cod-fish. The *whites* of eggs may be taken raw, poached, or soft boiled. Avoid all fats as far as possible, using only salt and pepper for seasoning. Mustard mixed with hot water, lemon juice or Worcester and Halford sauces may be used on meats if desired. A little celery may be eaten at dinner if desired. All other foods, drinks and condiments not mentioned above should be strictly prohibited."

This rigid diet is to be kept up until all traces of albumen or sugar respectively disappear from the urine.* When these have ceased to show themselves for a couple of weeks, the patient may be allowed one part of bread, toast or boiled rice, by bulk, and not by weight, to eight or ten parts of the beef eaten at a meal. When this new departure has been continued for four weeks without a return of the symptoms, the bread, toast or boiled rice, is increased to one part by bulk, to six of meat, and a piece of butter the size of a hickory nut is permitted as seasoning. Four weeks later, the proportion of bread, &c., is increased to one part in five, with a little increase of the butter. After another month the proportion may be one to four, and a month later, one to three. These

* The above are distinctive symptoms of "Bright's" disease and diabetes.

proportions are to be continued for three months, and then, if no sign of the disease be visible, the bread, toast, or boiled rice may be increased to one part to two of meat (the "normal" proportions). A little later milk warm from the cow (half a pint to a pint) is allowed, two hours after breakfast and dinner. Later still the patient may be allowed fruit, to the extent however of only one peach, apple, orange, or bunch of grapes per day, and sugar and cream may be used, but very moderately, in tea and coffee.

It will readily be understood that a patient whose only object is the reduction of fat, is under no necessity to follow out the system either so long or so strictly as here mentioned; but if he is serious in his determination to get rid of his superfluity, he cannot do so more certainly than by following out the prescribed regimen to a modified extent; say adhering to the "all meat" system for three or four weeks, and then relaxing its strictness by the several steps indicated, but at *fortnightly* intervals, till he reaches the "two-thirds," or "normal" limit. This should take about four months, and if he has meanwhile persevered in regular daily exercise with the dumb-bells or pulley-weight apparatus, he should (unless excessively corpulent at the outset) have lost his superfluity of fat, and be in fairly sound physical condition. After another

month or so of the "normal" regimen, he should be in such good condition as to be practically independent of strict dietetic rules; regular exercise and a little wholesome *caution* in the matter of eating and drinking being sufficient to keep him in vigorous health. The restrictions as to the non-consumption of the fat or skin with meat may thenceforth be disregarded; likewise the prohibition of soups and stews, salted or smoked meats, of milk with tea, of vinegar, of grapes and strawberries. Potatoes and other floury vegetables, pastry and new bread should still be avoided; also sweetmeats, sugar, and all foods into whose composition sugar largely enters.

The very slight amount of privation still demanded will come the easier, inasmuch as it will be found that the period of strict abstinence from sundry unwholesome things has sufficed, in a great measure, to destroy the taste for them. Thus it may be safely predicted that the man who has once learned to drink his tea without sugar will never again do otherwise, his palate having in the meantime been educated to a higher level; and in like manner the craving for rich pastry, sweetmeats, and highly-seasoned foods, once lost by disuse, will never return in the same degree; the new relish for plain beef and mutton having (to the great advantage of the digestive organs) not

merely superseded, but practically destroyed the taste for more savoury, but less wholesome, dishes.

The daily use of hot water at the hours stated should still be maintained, such use having a distinct hygienic value, even apart from any special rule of diet. So long as the flesh-food regimen is continued, the use of the hot water is not merely expedient, but absolutely necessary, being required for the complete solution of the salts thrown into the blood by such regimen.

L'ENVOI.

It is one of the special difficulties of a book of this kind, to know precisely where to end. The subject grows under one's hand. There seems always to be a little more, and yet a little more, which might be said with advantage. On the other hand, there is risk that excess of detail may obscure the general design; and that the reader, who might have been tempted by a little, may be repelled by the offer of "too much." We have endeavoured to hold the middle course; with what success we must leave the public to decide.

One parting assurance, however, we may give to every one who reads these pages. The hygienic principles laid down in this little book are of direct personal interest to every man, and therefore to *you*. Study and practise them, and in so doing you shall have three parts gained that first of earthly blessings—HEALTH.

THE END.

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For the explanation of this Plate, *see* Chapter V. (pp. 40 *et seq.*), THE MUSCLES OF THE BODY.

THE MUSCULAR SYSTEM.—PLATE II.

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